



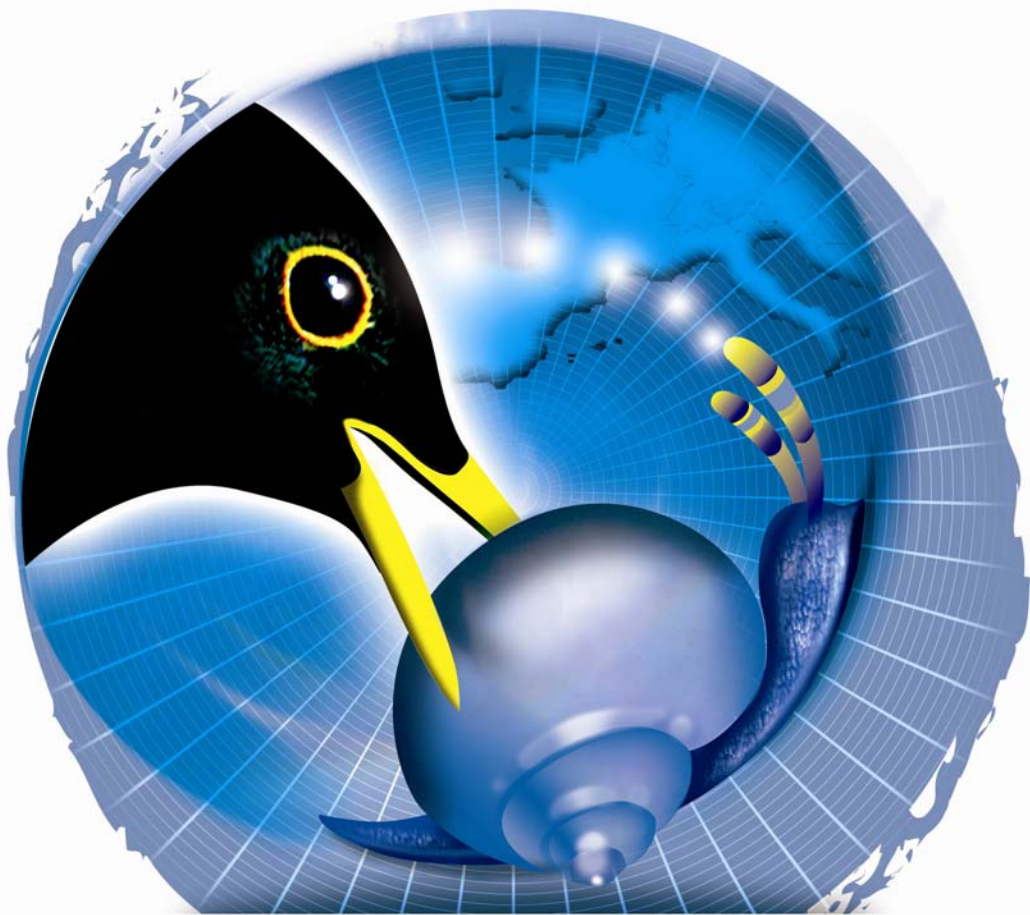
## **Priming effect and pre-exposure aggression in Siamese fighting fish**

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**ECBB 2008**

**4TH EUROPEAN CONFERENCE  
ON BEHAVIOURAL BIOLOGY**

**18-20 JULY :: DIJON :: FRANCE**

**Programme, Information and  
Abstracts**

4<sup>th</sup> European Conference on Behavioural Biology  
Dijon 2008

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FOURTH EUROPEAN CONFERENCE  
ON BEHAVIOURAL BIOLOGY

SPECIAL FOCUS:  
**INTERSPECIFIC INTERACTIONS**

DIJON, JULY 18<sup>TH</sup> – 20<sup>TH</sup> 2008

# Notes

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Welcome to the 4<sup>th</sup> European Conference on Behavioural Biology in Dijon, France.

We very much thank the following institutions and companies for donations and financial support:

Centre National de la Recherche Scientifique (CNRS)

Université de Bourgogne

Conseil Régional de Bourgogne

Communauté d'Agglomération du Grand Dijon

Société Française d'Etude du Comportement Animal (SFECA)

Cambridge University Press

Noldus

Oxford University Press

Proceedings of the Royal Society of London

Wiley Blackwell

Please make sure to wear your name-badge during the whole conference. The badge is your ticket for lunch and coffee.

# Informations

## Internet Access

A wifi connection will be available at a dedicated place within the congress centre: please check the information board at the entrance for password.

## Banquet on Saturday 19<sup>th</sup>

The Banquet will be organized at the "Domaine du Lac Kir", at 20 min driving from the Palais des Congrès. There will be live music and a cash bar.

Three buses will leave for the Banquet at 7 pm.

A second departure is scheduled at 7.40 pm.

A cash bar will be opened there from 7.20 to 1.30 am.

Buses will come back to the Palais des Congrès during the evening at 11.30 pm, 0.00, 0.30, 1.00, 1.30 and 2.00 am (2 buses at each time)

## Restaurants

Dijon offers a wide variety of restaurants, with several located at walking distance from the Congress Centre. We particularly recommend the following ones, all situated in the centre of town

\*: 15-20 euros for dinner (wine not included)

\*\*: 20-35 euros for dinner (wine not included)

\*\*\*: 50-60 euros for dinner (wine not included)

### *Near the Place de la République:*

- Pizzeria di Leo\*, 13 place de la République, 03 80 28 89 86
- Les Deux Fontaines\*\*, 16 place de la République, 03 80 60 86 45
- Le Tréma\*\*, 3 rue Claus Sluter, 03 80 70 14 15
- Le Smart\*\*, 8 rue Claus Sluter, 03 80 74 26 36
- Le Bora\*\*, 8 Petite Rue Pouilly, 03 80 73 60 59

### *Rue Monge*

- Restaurant Grill Le Sauvage\*\*, 64 rue Monge, 03 80 41 17 33
- Le Chabrot\*\*, 36 Rue Monge, 03 80 30 69 61

### *Place D'Arcy*

- Restaurant de la Porte Guillaume\*\*, Place D'Arcy, 03 80 50 80 50
- Restaurant Les Jardins de la Cloche\*\*\*, 03 80 30 12 32



*Near "Les Halles"*

- Villa Romana\*, 8 rue Quentin, 03 80 50 06 06
- Le Spice\*, 12 rue Odebert, 03 80 50 09 26
- Restaurant L'O\*\*, 14 rue Quentin, 03 80 50 06 18
- La Ruelle\*\*, 8 rue Quentin, 03 80 49 98 51
- Le Bistrot des Halles\*\*, 10 rue Bannelier, 03 80 49 94 15

*Elsewhere*

- Les Oenophiles\*\*\*, 18 rue Saint Anne, 03 80 30 73 52
- Le Pré aux Clercs\*\*\*, 13 Place Libération, 03 80 38 05 05

## **City Bus**

- Maps for city bus are available at the information desk (main entrance)

Two bus lane have a stop at the conference venue :

Liane 4 (going downtown: Grangier stop) : Palais des Congres stop

Liane 7 (going downtown : Darcy stop, and to the train station Gare SNCF stop) :

Congrexpo stop

Schedules are available at the information desk or on [www.divia.fr](http://www.divia.fr)

## **Taxi**

- Taxis Dijon: 03 80 41 42 12

- Taxis n°1: 03 80 36 70 00

- Taxi Bell: 03 80 65 26 24

# PROGRAMME

<b><i>Thursday 17<sup>th</sup> July</i></b>
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16:00-20:00 Registration  
 17:00-22:00 ASAB council meeting

<b><i>Friday 18<sup>th</sup> July: morning</i></b>
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8:30-9:00 Registration

9:00-9:30 Introduction  
 - **Mr. François Rebsamen**, Mayor of the City of Dijon,  
 Président of the "Communauté d'agglomération Dijonnaise"  
 - **Prof. Claude Mordant**, Vice-Président délégué à la Recherche  
 Université de Bourgogne

9:30-10:20 Geoffroy Saint-Hilaire Award (SFECA) Plenary lecture  
*(Romanée-Conti room)*  
 Chair- Vincent Fourcassié  
**Louis Lefebvre** "Social informers and thieves: are heterospecifics different  
 from conspecifics?"

10:20-10:45 Coffee break & posters

10:45-12:45 3 parallel sessions

Session 1	Session 2	Session 3
Science Market "Leadership and group decision in animals"  <i>(Santenay Chablis)</i>	Science Market "Predator perception and cognition in the evolution of prey defences" <i>(Musigny Pommard)</i>	General Programme "Personality"  <i>(Romanée-Conti)</i>

12:45-14:00 Lunch  
 12:45-14:00 Meeting of the Committee of European Societies for Behavioural Biology

<b><i>Friday 18<sup>th</sup> July: afternoon</i></b>
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14:00-16:00 3 parallel sessions (sessions 1, 2, 3)

Session 1	Session 2	Session 3
Science Market	Science Market	General programme
"Leadership and group decision in animals"	"Predator perception and cognition in the evolution of prey defences"	"Learning and cognition"
<i>(Santenay Chablis)</i>	<i>(Musigny Pommard)</i>	<i>(Morey-St Denis)</i>

16:00-16:30 Coffee break & posters

16:30-18:30 3 parallel sessions (sessions 1, 2, 3)

Session 1	Session 2	Session 3
Science Market	Science Market	General programme
"Leadership and group decision in animals"	"Predator perception and cognition in the evolution of prey defences"	"Communication"
<i>(Santenay Chablis)</i>	<i>(Musigny Pommard)</i>	<i>(Morey-St Denis)</i>

18:00-19:00 Bureau SFECA

18:30-19:45 Poster session

<b>Friday 18<sup>th</sup> July</b>
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## Parallel sessions:

### Session 1: Science Market

#### **Leadership and group decision making in animals** (*Santenay Chablis room*)

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Organisers: Odile Petit and Richard Bon

#### *Morning session (Santenay Chablis room)*

10:45-10:55 **Odile Petit & Richard Bon**: Introduction to the symposium

10:55-11:15 **Larissa Conradt** : Consensus decisions in animals

11:15-11:35 **Stéphan Reeb**: Temporal complementarity of leadership in shoals of golden shiners

11:35-11:55 **Gerald Kerth** : Group decision-making in fission-fusion societies: implications from field experiments in Bechstein's bat colonies

11:55-12:15 **Ilya Fischhoff et al.**: Leadership and conflict in the movements of plains zebra (*Equus burchelli*)

12:15-12:35 **Marie Bourjade et al.**: Decision-making processes in the collective movements of Przewalski horses: Influences of the environment

12:35-12:40 **Andrew J. King** : Baboon despots: unshared consensus decisions where interests conflict in a complex social system. (brief poster presentation)

12:40-12:45 **Lennart Pyritz** : Group movements in redfronted lemurs (*Eulemur fulvus rufus*) (brief poster presentation)

#### *Afternoon session 1 (Santenay Chablis room)*

14:00-14:20 **Nigel R. Franks & Elva J.H. Robinson** : "All for one or a few for all?"  
Decision-making in house hunting ant colonies.

14:20-14:40 **Cédric Sueur & Odile Petit** : True vote to choose the direction to move in Tonkean macaques

14:40-15:00 **Marie-Hélène Pillot et al.** : Incidental leaders and naïve followers in sheep

15:00-15:20 **Amandine Ramseyer et al.** : Decision-making in group departures of juvenile domestic geese

15:20-15:40 **Dora Biro & David J.T. Sumpter** : Leadership and compromise in homing pigeons

15:40-16:00 **Jérôme Buhl et al.** : From disorder to order in locust hopper bands

*Afternoon session 2 (Santenay Chablis room)*

- 16:30-16:50 **Irene Giardina** : Three dimensional reconstruction of starling flocks: an empirical investigation of collective animal behaviour.
- 16:50-17:10 **Jacques Gautrais et al.** : Displacement interactions in a fish school
- 17:30-17:50 **Vincent Fourcassié et al.** : Temporal organization of bi-directional traffic in ants
- 17:50-18:10 **Ashley J.W. Ward & Jens Krause** : Quorums, consensus and leadership in fish shoals
- 18:10-18:30 **General discussion**

**Session 2: Science Market**

**Predator perception and cognition in the evolution of prey defences** (*Musigny Pommard room*)

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Organisers: Candy Rowe and John Skelhorn

*Morning session (Musigny Pommard room)*

Chair – John Skelhorn

- 10:45-11:05 **John Skelhorn**: How do birds decide what to eat?
- 11:05-11:25 **Innes Cuthill**: Coincident disruptive coloration
- 11:25-11:45 **Tom Trosianko**: Trade-offs between disruptive coloration and crypsis: a cross species comparison
- 11:45-12:05 **Marina Dimitrova**: Concealed by conspicuousness: distractive prey markings and backgrounds
- 12:05-12:25 **Sami Merilaita**: The influence of visual background on prey detection and evolution
- 12:25-12:45 **Martin Stevens**: Fearful symmetry revisited: the protective value of conspicuous signals is not impaired by asymmetry in the field

*Afternoon session 1 (Musigny Pommard room)*

Chair – Hannah Rowland

- 14:00-14:20 **Nicola Marples**: Developments in dietary conservatism
- 14:20-14:40 **Candy Rowe**: Does tasting the difference make a difference?
- 14:40-15:00 **Leena Lindstrom**: Signal design and the evolution of aposematic signals
- 15:00-15:20 **Aronsson Marianne**: The role of internal colour pattern in avoidance learning
- 15:20-15:40 **Carita Lindstedt**: Hariness and warning colours as components of antipredator defence: additive and interactive benefits
- 15:40-16:00 **Daniel Osorio**: Visual learning and sensory generalization by poultry chicks

*Afternoon session 2 (Musigny Pommard room)*

Chair – Candy Rowe

- 16:30-16:50 **Alice Exnerova**: Personality matters: individual variation in reactions of naïve bird predators to aposematic prey
- 16:50-17:10 **Johanna Mappes**: Sex differences in the use of environmental cues for the learning of food preferences.
- 17:10-17:30 **Aleksandra Johansen**: From crypsis to aposematism: Experimental evidence for an adaptive ontogenetic colour change in the striated sheldbug
- 17:30-17:50 **Daniel Franks**: The evolution of warning signals in response to mimicry
- 17:50-18:10 **Katerina Svadova**: Gregariousness as a defense strategy in *Pyrrhocoris apterus*
- 18:10-18:30 **Hannah Rowland**: Exploring the alternative causal explanations for the existence of aposematic signal mimicry

### **Session 3: General programme (1)**

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*Morning session “Personality” (Romanée-Conti room)*

Chair - Denis Réale

- 10:45-11:00 **Joanne Clavel et al.** “Behavioural syndromes in specialist-generalist species”
- 11:00-11:15 **Maria de Lourdes Ruiz-Gomez et al.** “Coping strategies on rainbow trout: flexibility and distractability”
- 11:15-11:30 **Øyvind Øverli et al.** “Spot or not? Individual variation in the density of black melanin-based skin spots reflect stress coping style in salmonid fish”
- 11:30-11:45 **Dik Heg et al.** “Long term effects of a juvenile behavioural syndrome in the highly social cichlid *Neolamprologus pulcher*”
- 11:45-12:00 **Johanneke Oosten et al.** “Personalities in fish without genetic differences: a model”
- 12:00-12:15 **Christelle Scheid et al.** “Implications of individual temperament in a cooperative task”
- 12:15-12:30 **Alexander Wilson et al.** “Boldness and behavioural syndromes in bluegill sunfish (*Lepomis macrochirus*)”
- 12:30-12:45 **Wiebke Schütt et al.** “Adventurous zebra finch partnerships make for better parenting”



*Afternoon session 1 “ Learning & cognition” (Morey St Denis room)*

Chair – Marie-Jeanne Perrot-Minnot

- 14:00-14:15 **Ralph Bergmüller et al.** “Testing the social intelligence hypothesis in cleaner fish: a comparative approach”
- 14:15-14:30 **Douglas Chivers et al.** “Predator recognition by fishes: from simple learning to complex generalization”
- 14:30-14:45 **Julia Cnotka et al.** “The hippocampus in homing pigeons is affected by experience”
- 14:45-15:00 **Emmanuel Desouhant et al.** "Foraging and associative learning of visual signals in a parasitic wasp”
- 15:00-15:15 **Elena Dorosheva et al.** “Mental games between competitors: why beetles learn better than ants?”
- 15:15-15:30 **Gyula Gajdon et al.** “Kea (*Nestor notabilis*) do not use tools during natural foraging but spontaneously develop skills for doing so when tasks are offered experimentally”
- 15:30-15:45 **Nicolas Giret et al.** “Referential acquisition of human labels in African grey parrots (*Psittacus erithacus*): efficiency of a new learning method”
- 15:45-16:00 **Sofia Panteleeva et al.** “Springtail hunters of different levels of intelligence: behavioural versus cognitive specialization”

*Afternoon session 2 “Communication” (Morey St Denis room)*

Chair - Marc Théry

- 16:30-16:45 **Alexandra Hernandez et al.** “The role of auditory contact and pair bond on preferences for mate’s distance calls in female zebra finches”
- 16:45-17:00 **Raoul Ribot et al.** “Testing ring species predictions; vocal variation in a parrot, *Platycercus elegans*”
- 17:00-17:15 **Christina Richardson et al.** “Communicating effectively through a busy sensory channel: possible through the use of multiple signals?”
- 17:15-17:30 **Charlotte Curé et al.** "Nocturnal acoustic communication strategies: convergence and divergence in two sympatric seabirds”
- 17:30-17:45 **Franziska Schädelin et al.** “Extended Phenotype as Signal”
- 17:45-18:00 **Raquel Vasconcelos et al.** "Anthropogenic noise impacts acoustic communication of the intertidal-nesting Lusitanian toadfish”

<b><i>Saturday 19<sup>th</sup> July: morning</i></b>
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9:00-9:50      Plenary lecture (*Romanée-Conti room*)  
 Chair – Innes Cuthill  
**Redouan Bshary** “On the evolution and stability of mutualisms”

9:50-10:05    ***Tribute to Chris Barnard:***  
 Innes Cuthill and Luc-Alain Giraldeau

10:05-10:30   Coffee break & posters

10:30-13:00   4 parallel sessions (Sessions 4, 5a, 6, 7)

Session 4	Session 5a	Session 6	Session 7
Science Market	Science Market	General Programme	General Programme
"The ecology of personality: current status and perspectives"	30 <sup>th</sup> anniversary of the Ethological Society	"Mating systems, sexual selection & parental investment"	"Predation" + "Physiology & behaviour"
( <i>Santenay-Chablis</i> )	( <i>Givry Savigny</i> )	( <i>Romanée Conti</i> )	( <i>Musigny Pommard</i> )

13:00-14:00   Lunch

<b><i>Saturday 19<sup>th</sup> July: afternoon</i></b>
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14:00-16:00 4 parallel sessions (Sessions 4, 5b, 6, 7)

Session 4	Session 5b	Session 6	Session 7
Science Market	Science Market	General Programme	General Programme
"The ecology of personality: current status and perspectives"	"New perspectives on aggression"	"Mating systems, sexual selection & parental investment"	"Group living and sociality"
( <i>Santenay-Chablis</i> )	( <i>Givry Savigny</i> )	( <i>Romanée Conti</i> )	( <i>Musigny Pommard</i> )

16:00-16:30 Coffee break & posters

16:30-18:00 4 parallel sessions (Sessions 4, 5b, 6, 7)

Session 4	Session 5b	Session 6	Session 7
Science Market	Science Market	General Programme	General Programme
"The ecology of personality: current status and perspectives"	"New perspectives on aggression"	"Miscellaneous"	"Group living and sociality"
( <i>Santenay-Chablis</i> )	( <i>Givry Savigny</i> )	( <i>Meursault Nuit StG Corton</i> )	( <i>Musigny Pommard</i> )

18:00-18:45 ASAB AGM and AG SFECA

19:00-19:40 Departure to the banquet

## Parallel sessions:

### Session 4: Science Market

#### **The ecology of personality: current status and perspectives** (*Santenay Chablis room*)

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Organisers: Denis Réale, Niels Dingemanse & Jonathan Wright

#### *Morning session (Santenay Chablis room)*

10:30-10:35 Opening of the symposium - **Denis Réale**

Terminology, concepts and definitions

Chair - N.J. Dingemanse

10:35-10:45 **Anahita Kazem & Jonathan Wright** "What is 'interesting' about personality?  
Some less-explored themes and their implications"

10:45-10:55 **Sasha Dall** "Personality and sexual selection"

10:55-11:05 **Denis Réale** "Personality and degrees of specialisation"

11:05-11:30 **Discussion**

Natural selection on personality traits

Chair - N.J. Dingemanse

11:30-11:40 **John Quinn** "Natural selection on personality traits"

11:40-11:50 **Jörgen Johnsson** "Personality, variation and fitness: a fishy perspective"

11:50-13:00 **Discussion**

#### *Afternoon session (Santenay Chablis room)*

The link between personality differences and life-history strategies

Chair - D. Réale

14:00-14:10 **Peter Biro** "Are personality traits linked to life-history productivity"

14:10-14:20 **Adi Boon** "Acquisition, allocation, variable plasticity, and links to personality"

14:20-14:30 **Vincent Careau** "Energy metabolism and personality"

14:30-15:10 **Discussion**

The ecological conditions favouring correlations between personality traits – Chair - D. Réale

15:10-15:20 **Niels J. Dingemanse** "Ecological conditions favouring the evolution of  
behavioural syndromes"

15:20-15:30 **Claudia Mettke-Hofmann** "Do ecological extremes hamper the evolution of  
coping styles?"

15:30-16:00 **Discussion**

Personality, conservation and invasive biology

Chair - J. Wright

16:30-16:40 **Jason Watters** "Are the personalities of captive animals relevant to wild conservation?"

16:40-16:50 **Julien Cote** "Personality traits and individual's ability to invade"

16:50-17:10 **Discussion**

Personality in a social context

Chair - J. Wright

17:10-17:20 **Lucy Browning** "Personality and cooperative breeding"

17:20-17:30 **Dik Heg** "Personalities in a cooperative breeding context"

17:30-17:55 **Discussion**

17:55-18:00 Closing of the symposium - **J. Wright**

### **Session 5a: Science Market**

**30<sup>th</sup> anniversary of the Ethological Society** (*Givry Savigny room*)

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Organiser: Redouan Bshary

10:30-11:05 **Carel ten Cate** "Sensory system biases, learning biases and the evolution of sexual signals."

11:05-11:40 **Theo Bakker** "On kin recognition and sexual selection"

11:40-12:15 **Anne-Kathrin Eggert** "Starve the mother, kill the babies: mechanisms of reproductive skew in burying beetles"

12:15-12:50 **Martin Wikelski** "Going wild: what we can learn from animal movement studies"

12:50-13:00 Laudatios for new honorary members of the society: **Serge Daan & Dietrich von Holst**

### **Session 5b: Science Market**

**New perspectives on aggression** (*Givry Savigny room*)

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Organiser: Robert Elwood

*Afternoon session 1 (Givry Savigny room)*

Chair - Mark Briffa

14:00-14:05 **Mark Briffa** Introduction to symposium

14:05-14:30 **Bob Elwood** "Variable assessment rules in aggressive contests"

- 14:30-14:55 **Lesley Morrell** "Why are small males aggressive?"  
 14:55-15:20 **Jürgen Heinze** "The evolution of lethal fighting in the ant genus *Cardiocondyla*"  
 15:20-15:45 **Ian Hardy** "Parasitoid wasp contests"  
 15:45-16:00 **Discussion**

*Afternoon session 2 (Givry Savigny room)*

Chair - Ian Hardy

- 16:30-16:55 **Mark Briffa** "Proximate mechanisms and strategic decisions in animal contests"  
 16:55-17:20 **Virginie Canoine** "Aggressive behaviour differs between resident and migratory Stonechats"  
 17:20-17:45 **Gareth Arnott** "Probing motivation to test for assessment in convict cichlid contests"  
 17:45-18:00 **Discussion**

## **Session 6: General programme (2)**

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*Morning session "Mating systems, sexual selection & parental investment" (Romanée Conti room)*

Chair – Bruno Faivre

- 10:30-10:45 **Barbara Taborsky et al.** "Size-assortative mating by prudent habitat choice"  
 10:45-11:00 **Maud Bonato et al.** "Male ostrich feather colour signals humoral immunocompetence and affects offspring growth rates"  
 11:00-11:15 **Charlotte Faurie et al.** "Father – offspring resemblance predicts paternal investment and offspring condition in humans"  
 11:15-11:30 **Tim Fawcett et al.** "Previous experiences shape optimal mate preferences"  
 11:30-11:45 **Patrick Gouat et al.** "Polygyny is costly for females of the monogamous mound-building mouse"  
 11:45-12:00 **Shirley Raveh et al.** "Mating behaviour and parasite – host interactions in male columbian ground squirrels (*spermophilus columbianus*)"  
 12:00-12:15 **Albert Ros et al.** "Is brood size related to male quality and androgen levels in the peacock blenny?"  
 12:15-12:30 **Mareike Stöwe et al.** "Behavioural pair synchrony modulates hormonal stress response in Great tits (*Parus major*)"  
 12:30-12:45 **Michael Taborsky et al.** "Fixed and flexible alternative reproductive tactics coexist in a snail-brooding cichlid"  
 12:45-13:00 **Alexandre Villers et al.** "Extinction is not the opposite of colonization: lek spatial structure changes during two opposite population dynamic regimes"

*Afternoon session 1 “Mating systems, sexual selection & parental investment” (Meursault NuitStG Corton room)*

Chair – Gabriele Sorci

- 14:00-14:15 **Claudia Fichtel et al.** “Out of sight, but not out of mind; Behavioral coordination in pair-living sportive lemurs (*Lepilemur ruficaudatus*)”
- 14:15-14:30 **Jesus Martínez-Padilla et al.** “The relative effect of testosterone and parasites on testosterone-mediated carotenoid-based ornaments: does social context mediate carotenoid allocation priorities?”
- 14:30-14:45 **Hervé Mulard et al.** “Individual recognition and genetic bases of mating patterns in a monogamous seabird, the black-legged kittiwake (*Rissa tridactyla*)”
- 14:45-15:00 **Pekka Kontiainen et al.** “Aggressiveness in a variable environment: Ural owl and nest defence”
- 15:00-15:15 **Mark Mainwaring et al.** “Hatching asynchrony, parental provisioning and nestling begging within zebra finch broods”
- 15:15-15:30 **Ralf Mullers et al.** “Individual variation in parental behaviour predicts chick survival of Cape gannets (*Morus capensis*).”

*Afternoon session 2 “Miscellaneous” (Meursault NuitStG Corton room)*

Chair – François-Xavier Dechaume-Moncharmont

- 15:30-15:45 **Sébastien Lebreton et al.** “Host quality discrimination by solitary parasitoid females: impact on oviposition strategies and fitness”
- 15:45-16:00 **Colin De Bruyn et al.** “Utilization of two sympatric sea-urchin host species by the ectoparasite pea-crab, *Dissodactylus primitivus*”
- 16:30-16:45 **Ordino Kok et al.** “Interspecific interaction amongst four sympatric carnivore species in the Free State, South Africa.”
- 16:45-17:00 **Ben Brilot et al.** “Water bathing in European starlings improves flight manoeuvrability”
- 17:00-17:15 **Jana Marešová et al.** “We all appreciate and thus support the same species”
- 17:15-17:30 **Sergey Naidenko et al.** “To fight a brother: for what?”
- 17:30-17:45 **Sandy Millot et al.** “Risk-taking behavior in a marine fish (*Dicentrarchus labrax*): influence of selection for growth on responses”

### **Session 7: General programme (3) (*Musigny Pommard room*)**

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#### *Morning session 1 “Predation” (*Musigny Pommard room*)*

Chair – Luc-Alain Giraldeau

- 10:30-10:45 **Andrew Wood *et al.*** “Strategy emergence from evolutionary simulations of predatory response”
- 10:45-11:00 **Gaëlle Buron *et al.*** “Fear-related behaviors to predator odors : comparison between 2,4,5-trimethylthiazoline (TMT) and natural fox feces in mice.”
- 11:00-11:15 **Jaimie Dick *et al.*** “Parasite mediation of interspecific interactions; effects on intraguild predation and the functional response”
- 11:15-11:30 **Monique Ellmer *et al.*** “Interference and predation in a vole-shrew study system; effects and seasonal variation”
- 11:30-11:45 **Christos Ioannou *et al.*** “Why do cryptic animals keep still?”
- 11:45-12:00 **Mateusz Jochym *et al.*** “How do odours of predators affect small rodent prey?”

#### *Morning session 2 “Physiology & behaviour” (*Musigny Pommard room*)*

Chair – Norbert Sascher

- 12:00-12:15 **Aurélie Goutte *et al.*** “Effects of experimentally increased stress hormones levels on breeding success and survival in a long-lived bird: the Black-legged Kittiwake”
- 12:15-12:30 **Juan Diego *et al.*** “Do chicks present adaptive responses according to predation risk? A hormonal perspective.”
- 12:30-12:45 **Sara Schaafsma *et al.*** “Effects of early exposure to gonadal steroids on behavioural and brain lateralization in a fish species”
- 12:45-13:00 **Carsten Schradin *et al.*** “Endocrine control of alternative male reproductive tactics in a small mammal”

#### *Afternoon session 1 “Group living and sociality” (*Musigny Pommard room*)*

Chair – Philipp Heeb

- 14:00-14:15 **Hanno Hildenbrandt *et al.*** “Massive flocks under attack: modeling aerial displays of starlings”
- 14:15-14:30 **Audrey Sternalski *et al.*** “Recruitment mechanisms and behaviours in a gregarious raptor species”
- 14:30-14:45 **Jolyon Faria *et al.*** “Group decision making in fish shoals”



- 14:45-15:00 **Lisa Collins et al.** "The effect of environment on spatial clustering and activity levels in laying hens"
- 15:00-15:15 **Stacey Lee-Jenkins et al.** "Role of familiarity in the formation of shoals in juvenile fishes: a comparison of two sympatric species"
- 15:15-15:30 **Ivan Puga-Gonzalez et al.** "Grooming patterns and reconciliation in primates: a minimal model."
- 15:30-15:45 **Aur lie Buffin et al.** " Scintigraphy of a social organisation: the dynamic of food flow in an ant colony"
- 15:45-16:00 **C cile Schweitzer et al.** "Low social motivation favours social bonding in young Japanese quail (*Coturnix japonica*)"

*Afternoon session 2 "Group living and sociality" (Musigny Pommard room)*

Chair – Sasha Dall

- 16:30-16:45 **Carole Di-poi et al.** "Social recognition related to Arginine Vasotocin system in juvenile sea bass (*Dicentrarchus labrax*)."
- 16:45-17:00 **Charlotte Hemelrijk et al.** "Female Dominance Over Males In Primates: Self-Organisation And Sexual Dimorphism"
- 17:00-17:15 **Mylene Mariette et al.** "Coloniality and social foraging in wild Zebra finch"
- 17:15-17:30 **Timothy Roper et al.** "Social organisation, mating system and ranging behaviour of Eurasian badgers in an urban environment"
- 17:30-17:45 **Christine Schwab et al.** "Similarity of socio-positive relationships between adult pair partners and between juvenile nestmates in jackdaws (*Corvus monedula*)"

<b><i>Sunday 20<sup>th</sup> July morning</i></b>
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- 9:40-10:30 Plenary lecture (*Romanée Conti room*)  
 Chair- Frank Cézilly  
**Robert Poulin** “Host manipulation by parasites: genetic and epigenetic aspects”
- 10:30- 11:00 Niko Tinbergen award  
 Chair – Redouan Bshary  
**Oliver Krueger**
- 11:00-11:30 Coffee break & posters
- 11:30-12:45 3 parallel sessions (sessions 8, 9, 10)

Session 8	Session 9	Session 10
General Programme	General Programme	General Programme
"Information use"	"Foraging"	"Cooperation & conflict"
( <i>Romanée-Conti</i> )	( <i>Santenay Chablis</i> )	( <i>Musigny Pommard</i> )

- 12:45-14:00 Lunch
- 12:45-14:00 Ethological Society Meeting

<b><i>Sunday 20<sup>th</sup> July afternoon</i></b>
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14:00-16:00 3 parallel sessions (sessions 11, 12, 13)

Session 11	Session 12	Session 13
Science Market	Science Market	Science Market
"Brain size and behaviour"	"Human-animal social relationships: functions and mechanisms"	"Parasite-mediated behavioural manipulation: from mechanisms to evolution"
( <i>Meursault Nuit StG Corton</i> )	( <i>Santenay Chablis</i> )	( <i>Musigny Pommard</i> )

16:00-16:30 Coffee break & posters

16:30-18:00 3 parallel sessions (sessions 11, 12, 13)

Session 11	Session 12	Session 13
Science Market	Science Market	Science Market
"Brain size and behaviour"	"Human-animal social relationships: functions and mechanisms"	"Parasite-mediated behavioural manipulation: from mechanisms to evolution"
( <i>Meursault Nuit StG Corton</i> )	( <i>Santenay Chablis</i> )	( <i>Musigny Pommard</i> )

## Parallel sessions:

### Session 8: General programme (4) (*Romanée Conti room*)

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#### *Morning session “Information use”*

Chair – Louis Lefebvre

11:30-11:45 **Anna Braun et al.** "What is more attractive for ravens: to pilfer food or object caches?"

11:45-12:00 **Maëlle Durey et al.** “Do female Siamese fighting fish copy the mate choice of others?”

12:00-12:15 **Frédéric Mery et al.** “Mate copying and stimulus generalization in an invertebrate: personal versus public information use”

12:15-12:30 **Ana Pinto et al.** “Look who’s watching: cleaner fish *Labroides dimidiatus* adjust audience effects to the quality of bystanders”

12:30-12:45 **Mike Webster et al.** “Costly information: Predation risk and social learning in fish”

### Session 9: General programme (5) (*Santenay Chablis room*)

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#### *Morning session “Foraging”*

Chair – Mark Briffa

11:30-11:45 **Cécile Fruteau et al.** «The law of supply and demand explains changes in the experimentally altered market values of low-ranking vervet monkeys”

11:45-12:00 **Thilo Liesenjohann et al.** “Foraging under uniform risk from different types of predators”

12:00-12:15 **Carlos Bernstein et al.** “Host- or food-searching and egg maturation strategies in parasitoids: the dilemma of choosing between immediate or eventual fitness gains.”

12:15-12:30 **Ana Sendova-Franks et al.** “Famine Relief in Ant Colonies”

12:30-12:45 **Dina Azevedo et al.** “Fidelity of *Dinoponera quadriceps* workers to foraging routes”

## **Session 10: General programme (6) (*Musigny Pommard room*)**

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### *Morning session “Cooperation & conflict”*

Chair – Nina Wedell

- 11:30-11:45 **Frédérique Dubois et al.** “Constraints to the evolution of animal cooperation among unrelated individuals”
- 11:45-12:00 **Roberto Bonanni et al.** “Cooperation and numerical assessment of opponents in conflicts between groups of feral dogs (*Canis lupus familiaris*)”
- 12:00-12:15 **Jennifer Oates et al.** “Spatial variation in cheating behaviour of the cleaner wrasse *Labroides bicolor*”
- 12:15-12:30 **Peter Biedermann et al.** “Cooperative brood care and fungus farming in Xyleborine beetles”
- 12:30-12:45 **Lesley Morrell et al.** “Mechanisms for aggregation in animals: rule success depends on ecological variables”

## **Session 11: Science Market**

### **Brain size and behaviour (*Meursault Nuit StG Corton room*)**

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Organisers: Sue Healy and Candy Rowe

#### *Afternoon session 1 (Meursault Nuit StG Corton room)*

- 14:00-14:10 **Sue Healy** Introduction
- 14:10-14:30 **Daniel Sol** “Brain size and the body size diversification in birds”
- 14:30-14:50 **Suzanne Shultz & Robin Dunbar** “Species differences in executive function performance correlate with neocortex and total brain size across non-human primates”
- 14:50-15:10 **Jean-Francois Lemaitre** “Evolution of brain size in mammals: a role for sperm competition?”
- 15:10-15:30 **Katherine Buchanan et al.** “Environmental and genetic control of the avian song system”
- 15:30 **Discussion**

#### *Afternoon session 2 (Meursault Nuit StG Corton room)*

- 16:20-16:40 **Simon Reader** “Understanding cognition needs proper comparative study”
- 16:40-17:00 **Louis Lefebvre** “Is the comparative study of ‘cognitive complexity’ at the level of the whole brain a waste of time?”
- 17:00-17:20 **Candy Rowe** “Comparative studies of brain size: what have we learned and where next?”
- 17:20 **Discussion**

## Session 12: Science Market

### Human-animal social relationships: functions and mechanisms (*Santenay Chablis room*)

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Organisers: Clive Wynne and Kurt Kotrschal

#### Afternoon session 1 (*Santenay Chablis room*)

Chair – Kurt Kotrschal

14:00-14:20 **Monique Udell** “When wolves look to humans: Domestication and social cognition in domestic dogs.”

14:20-14:40 **Enikő Kubinyi et al.** “The role of canine genetic traits behind dog-human relationship: A starter”

14:40-15:00 **Clive Wynne et al.** “The Ontogeny of Theory of Mind abilities in dogs (*Canis familiaris*)”

15:00-15:20 **Manuela Wedl et al.** “Effects of personality and sex on behavioural patterns and stress coping in human-dog dyads”

15:20-15:40 **Sarah Marshall et al.** “Owner vs Stranger influence on the dogs' performance in two food discrimination tasks.”

15:40-16:00 **Holly Miller et al.** “Dogs Accurately Search for Invisibly Displaced Objects”

#### Afternoon session 2 (*Santenay Chablis room*)

Chair – Clive Wynne

16:30-16:50 Marine **Legrand et al.** “Public pigeon houses: redomesticating feral pigeons?”

16:50-17:10 Kurt **Kotrschal et al.** “Towards the nature of the relationship between humans and their companion animals”

17:10-17:30 **General discussion**

## Session 13: Science Market

### Parasite-mediated behavioural manipulation: from mechanisms to evolution (*Musigny Pommard room*)

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Organisers: Marie-Jeanne Perrot-Minnot, Thierry Rigaud, Frank Cézilly

#### Afternoon session 1 (*Musigny Pommard room*)

Chair - Thierry Rigaud

14:00-14:15 Opening: **Frank Cézilly et al.** “Revisiting host manipulation by parasites”

14:15-14:30 **Julien Varaldi** “Virus-generated polymorphism of egg-laying strategy in a parasitoid wasp”

14:30-14:45 **Jenny Shaw** “The neurobiological mechanisms of behavior modification in a killifish and its brain trematode *metacercariae*”

14:45-15:00 **Frédéric Thomas** “Exploitation of host compensatory responses: the must of manipulation?”

15:00-15:15 **Tim Sparkes** "Behavioral and physiological mechanisms underlying parasite-related mating suppression in an intermediate host (*Isopoda*)"

15:15-15:30 **Shelley Adamo** "Sickness behaviour: an adaptive response to infection, but also an opportunity for parasitic manipulation of behaviour"

15:30-15:45 **Discussion**

*Note: for this session, coffee break begins 15 min before normal time, but second session begins earlier...*

*Afternoon session 2 (Musigny Pommard room)*

Chair – Frédéric Thomas

16:15-16:30 **Iain Barber** "When should parasites manipulate host behaviour?"

16:30-16:45 **Sean Rands** "When should the worm turn? The evolution of host manipulation strategies in parasites"

16:45-17:00 **Nathalie Franceschi** "Variation between parasite families in the behavioural manipulation induced by the acanthocephalan *Pomphorynchus laevis* in *Gammarus pulex*"

17:00-17:15 **Otto Seppala** "Host manipulation in the world of dead-end predators"

17:15-17:30 **Vincent Medoc** "The role of non-host predator avoidance in parasitic strategies"

17:30-17:45 **Discussion**

# Notes



# ORAL SESSIONS ABSTRACTS

Alphabetical order

## **Sickness behaviour: an adaptive response to infection, but also an opportunity for parasitic manipulation of behaviour**

**Adamo Shelley**

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Most pathogens activate an immune response inside their host. Hosts can take advantage of this and adaptively alter their behaviour in response to infection. In both vertebrates and invertebrates, factors released by the activated immune system can alter neural activity resulting in sickness behaviour. However, parasites have evolved to circumvent host immune systems. In some cases, they appear to induce the immune system to alter host behaviour in such a way that benefits the parasite. For example, the parasitoid wasp *Cotesia congregata* induces a massive immune response upon exiting its caterpillar host. This immune response includes the release of octopamine. During a normal immune response, the hemolymph octopamine concentration returns to baseline within an hour. In parasitized caterpillars, however, octopamine levels remain elevated for 3 days. Increased octopamine concentrations in the hemolymph help produce the decline in feeding observed in immune-challenged caterpillars. By augmenting and extending illness-induced anorexia and other sickness behaviours in its host, *C. congregata* increases the likelihood of its own survival.

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*Notes*

### **Probing motivation to test for assessment in convict cichlid contests.**

**Arnott Gareth**, Elwood Robert

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The ability of a contestant to assess their opponents' fighting ability (RHP) relative to their own, termed mutual assessment, has recently been questioned. It is possible that each contestant may only have information about its own abilities or state, incurring costs up to a particular threshold then giving up, termed self assessment. Using convict cichlids (*Archocentrus nigrofasciatus*), we outline a technique, derived from studies in hermit crabs, which probes the motivation of the animal to fight. We employ a novel stimulus to cause a startle response in one contestant of an aggressively interacting pair, whereby the animal temporarily stops fighting. The time taken to resume the contest allows a measure of the motivation to fight from which we can infer if any information concerning opponent asymmetries has been gathered. Motivation should be dependent on the size of the opponent if there is mutual assessment, but independent of opponent size in self assessment.

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## **The role of internal color patterns in avoidance learning.**

**Aronsson Marianne**, Gamberale-stille Gabriella

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Animals that signal their unprofitability to potential predators often use a conspicuous color pattern consisting of bright colors in combination with a black distinct pattern. Several hypotheses have been put forward about the function of these internally contrasting patterns. Earlier studies have shown that prey contrast against the background increases avoidance learning in chicks, and this finding has occasionally been extended to also explain the presence of internal patterns. We have conducted two experiments to investigate the role of patterns in avoidance learning in domestic chicks. In one study we investigate what predators attend to when learning an aposematic color pattern, a conspicuous color and/or a black pattern. In a second study we investigate the relative importance of within-prey pattern contrast and prey contrast against the background for avoidance learning. In both experiments domestic chicks were trained to forage in an arena for palatable or unpalatable mealworms. Our experiments show that chicks pay more attention to the warning color than to the pattern itself, even if both features predict the outcome equally well. In addition, for the colors used, avoidance learning is faster for prey on a contrasting background, but there is no effect of the presence of an internal contrasting black pattern on avoidance learning. In conclusion, we find no support for internal patterns improving avoidance learning.

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## **Fidelity of *Dinoponera quadriceps* workers to foraging routes**

**Azevedo Dina L.O.**, Medeiros Jeniffer C., Araujo Arrilton

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Foraging is one of the most important activities for guaranteeing survival of an individual; that would not be different in relation to insects. Among ants, even those which are solitary foragers, without any recruitment signalling, such as *Dinoponera quadriceps* (Formicidae, Ponerinae), the direction taken by a worker during foraging might reflect the availability of feeding resources in the environment, as well as fidelity to a specific foraging route. This work raised the question: how constant are *D. quadriceps* workers in relation to the routes they follow during the outside-the-nest activities? Observations were developed along 18 months (Feb/2005 to Nov/2006) in an area of secondary Atlantic forest, "Floresta Nacional de Nisia Floresta" - ICMBiod, north-eastern Brazil. The workers, previously marked, were observed since leaving until returning to the nest, when possible; behaviours were registered through instantaneous focal animal and all occurrences. Small flags were used to mark the route every 5 min. Foraging took most of the time of *D. quadriceps* while in outside-the-nest activities. Based in the register of individual moving along the study, we verified that workers were constant concerning their routes during foraging. The colony's total foraging area reflected all individual routes, outlining a foraging area with a diffuse design.

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## On kin recognition and sexual selection

**Bakker Theo C.M.**

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We are using the nest-building three-spined stickleback, *Gasterosteus aculeatus*, and the cave-breeding West African cichlid species *Pelvicachromis taeniatus* as model species. Males of both species are territorial and brightly coloured. *P. taeniatus* females also have a bright nuptial coloration. Sticklebacks have male only parental care while *P. taeniatus* shows biparental broodcare. Experiments showed that both species are capable of olfactory kin recognition, male sticklebacks also in a parental context. The most plausible mechanism is phenotype matching but *P. taeniatus* may be capable of self-referent phenotype matching because males can discriminate between their own smell and that of a familiar brother. During mate choice experiments, female sticklebacks avoided mating with familiar kin but both sexes of *P. taeniatus* preferred their kin as mating partner. Inbreeding depression was clearly present in sticklebacks but non-existent in *P. taeniatus*. Moreover, related pairs in the latter cared better for their offspring than unrelated pairs. Both species possess multiple signals. In *P. taeniatus* colour signals and body size are important cues in mate choice. In sticklebacks, ultraviolet signals play a prominent role in mutual mate choice, and are at least as important as the well-known red throat coloration in males. UV-signals also play a role in non-sexual contexts, and make sticklebacks more vulnerable to predation.

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## When should parasites manipulate host behaviour?

**Barber Iain**

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Direct field tests of the manipulation hypothesis (MH) are notoriously difficult to design and carry out, and the results they generate perhaps even more difficult to interpret. In lieu of such direct evidence, alternative tests of the main predictions of the MH are often undertaken. One of the most promising routes is to examine temporal changes in the behaviour of (preferably experimentally) infected intermediate hosts. The expectation is that, if changes in host behaviour coincide with the infectivity of the parasite to the next host, this constitutes good evidence for adaptation. In this talk I will argue that, in general, insufficient attention has been given to the parasite fitness consequences of host behaviour change. A re-analysis of a classic dataset and new evidence from our own studies shows that the link between larval parasite size and 'infectivity' in the definitive host may not be as clear as is often assumed. In addition, the size of a larval parasite stage at transmission can also affect adult egg output. It also seems that conditions experienced during parasite development can also affect the relationship between larval parasite size and adult fecundity, possibly in unexpected ways. Therefore, I suggest that before we can properly predict the size at which larval parasites 'should' affect intermediate host behaviour we must consider more fully the relationship between larval size /development and the potential fitness of adult parasites in definitive hosts

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## Testing the social intelligence hypothesis in cleaner fish: a comparative approach

**Bergmüller Ralph**, Malapert Aurore, Pinto Ana

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The social intelligence hypothesis proposes that social challenges, including the problems individuals face in cooperative interactions, are likely to select for particular cognitive abilities. Earlier studies in a cleaning mutualism revealed a conflict of interest between cleaner fish (*Labroides dimidiatus*) and their clients. Client fish visit cleaning stations to get their parasites removed by cleaners, but cleaners prefer client mucus they obtain by biting the clients. Clients may respond to such ‘cheating’ of cleaners by punishing them. As cleaners rely on their social competence to acquire food, the cleaner-client mutualism is an excellent system to study cognition in the context of social interactions. To test whether social challenges predispose certain cognitive abilities, we compared the cognitive performance of individuals of 9 species of wrasses which differ in the degree of cleaning interactions, i.e. ‘professional’ cleaners, facultative cleaners and non-cleaning species. We conducted a series of comparative tests involving: (1) a discrimination test, (2) a side preference test and (3) an interactive test in which individuals learned to feed against a food preference. Additionally, we measured shyness and boldness of individuals to assess potential effects of this trait on learning performance. We discuss the results of this study in the light of the social intelligence hypothesis for the evolution of cognitive ability.

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## Host- or food-searching and egg maturation strategies in parasitoids: the dilemma of choosing between immediate or eventual fitness gains.

Bernstein Carlos<sup>1</sup>, Jervis Mark<sup>2</sup>

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Many parasitoid wasps and flies feed habitually on sugar-rich materials in the wild. Consumption of these ‘non-host foods’ generally results in increased life expectancy, dispersal capacity, and realized fecundity. Usually in the wild, hosts and food sources are in locations within the habitat. A female parasitoid therefore faces a choice as to which of the two types of resource she should forage for. Foraging for hosts will increase the likelihood of her obtaining ‘immediate’ fitness gains, but it will decrease her life expectancy. On the other hand, foraging for food will defer egg-laying to a later stage in adult life (constituting an ‘immediate’ reproductive opportunity cost), and will also incur energetic and mortality costs. However, feeding will increase opportunities to locate hosts in the future. Using stochastic dynamic programming backward simulation, we have previously shown how, in relation to egg maturation strategy, parasitoid females should forage so as to optimize trade-offs with respect to the use of time and metabolic resources, and also mortality risks. In this paper, we present the results of forward simulations, focusing on how egg maturation strategy determines: (i) the degree of time- and egg-limitation experienced over the female's lifetime, and (ii) lifetime reproductive success.

## Cooperative brood care and fungus farming in Xyleborine beetles

**Biedermann Peter H.W.**<sup>1</sup>, Klepzig Kier D.<sup>2</sup>, Meister Andrea<sup>1</sup>, Taborsky Michael<sup>1</sup>

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Most bark beetles (Scolytinae, Platypodinae) use symbiotic fungi for nutrition. The most advanced associations with fungi are found in the ambrosia beetles, which all utilise mutualistic ascomycete fungi as their main food source. These fungi grow on the walls of tunnels excavated by the beetles in the heartwood of trees. Fungus gardening has long been hypothesized in ambrosia beetles, but was never actually observed. Here we present the first detailed behavioural study of ambrosia beetles. We kept two distantly related species in artificial medium and observed their behaviour in seminatural and experimental conditions. We found that fungus gardening and hygienic behaviour accounts for a large proportion of the time budget of larvae and adults within their galleries. As usually only one female produces offspring within the gallery, the behaviour shown by non-reproductive group members is apparently altruistic. Ambrosia beetles provide one of the best model systems for the study of the evolution of advanced sociality based on mutualistic interspecific relationships.

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## Leadership and compromise in homing pigeons

**Biro Dora**<sup>1</sup>, Sumpter David J.T.<sup>2</sup>

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Experiments with single homing pigeons have revealed that given sufficient experience with a release site, individuals come to develop their own preferred, idiosyncratic routes home. Under natural conditions, however, pigeons are highly gregarious, travelling in groups which may encompass individuals with differing levels of navigational experience, knowledge, and preferences. We tested how individuals with conflicting information resolve their differences, by releasing birds in pairs where the two individuals differed in their preferred routes home. Using miniature GPS trackers to record homing routes in precise detail, we observed instances of both compromise (birds taking intermediate routes) and leadership (the pair taking the route preferred by one of the birds). We use a mathematical model incorporating two main forces acting on birds (attraction to own preferred route and attraction to flight partner) to show that these differential outcomes could result from the same decision-making process based on a simple set of behavioural rules – with a switch between the two occurring at a critical level of difference in individuals' directional preferences. We also show that pairs navigate more efficiently than do individual birds, revealing a clear navigational advantage to grouping. Finally, we discuss properties of birds that enable them to assume leadership roles, given that these seem to be related neither to social dominance nor to inherently superior navigational skills.

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*Notes*

**Are personality traits linked to life-history productivity?**

**Biro Peter**

Abstract not received

## Cooperation and numerical assessment of opponents in conflicts between groups of feral dogs (*Canis lupus familiaris*)

Bonanni Roberto<sup>1</sup>, Valsecchi Paola<sup>1</sup>, Natoli Eugenia<sup>2</sup>

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In conflicts between social groups, competitors might be expected to adjust their cooperative agonistic behaviour according to the number of individuals in their own and the opposing group. This hypothesis was tested in a population of feral dogs living in a suburban environment. The study focused on three packs (a total of 30 individuals) and 84 intergroup conflicts were recorded (ad libitum sampling). Analysis of the spatial distribution of intergroup conflicts (minimum convex polygon) indicated that packs were not defending exclusive areas. The frequency of attacking opposing groups by at least one pack member was higher when its pack outnumbered opponents ( $\chi^2 = 13.68$ ,  $P = 0.0002$ ); on the contrary, the ratio of opponents to that of companions was significantly higher in conflicts where the majority of pack members retreated ( $U = 565$ ,  $P < 0.04$ ). However, in case dogs attacked larger packs the proportion of dogs attacking opponents was significantly higher ( $U = 171.5$ ,  $P < 0.03$ ). Gender did not significantly affect participation in intergroup conflicts. Moreover, individual differences in the extent of participation were not univocally predicted by variables such as dominance rank and leadership across different packs. These results suggest that, despite a very long history as domesticated animals, feral dogs are able to assess relative group size and to adjust their cooperative agonistic behaviour to minimize risks and possibly to maximize individual mutualistic benefits.

## Male ostrich feather colour signals humoral immunocompetence and affects offspring growth rates

Bonato Maud<sup>1</sup>, Evans Matthew R.<sup>2</sup>, Hasselquist Dennis<sup>3</sup>, Cloete Schalk W.P.<sup>4</sup>, Cherry Michael I.<sup>1</sup>

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Ostriches (*Struthio camelus*), are fast growing birds and a remarkable feature of chick cohorts is that they differ greatly in size. As disease may influence growth rates, we examined whether variation in levels of immunocompetence in both parents and offspring, as well as secondary sexual traits of male parents, are related to solutions for chick growth rate. We measured cell-mediated responses by injecting phytohaemagglutinin; and humoral immunocompetence by recording the antibody response to a diphtheria-tetanus vaccine. The colouration of feathers, bill, neck and legs of male ostriches, maintained in a breeding flock, was measured using UV-visible spectrophotometry. Chicks were weighed monthly to derive solutions for growth rates. These weights were used to obtain solutions for live weight (indicative of growth rate) for parents and offspring using an animal model. Parentage analysis was determined using microsatellite markers. We found that chicks with higher diphtheria and tetanus responses had higher solutions for growth rate. Solutions for chick growth rate were also positively correlated to their father's response to the diphtheria vaccine and their mother's response to the tetanus vaccine. Cell-mediated responses in chicks were related neither to solutions for growth rate nor to parental responses. The colour of white feathers in males has a strong effect on solutions for offspring growth rate and could serve as a signal to females of male humoral immunocompetence.

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Notes

## Acquisition, allocation, variable plasticity, and links to personality

Boon Adrienne K.<sup>1</sup>, Reale Denis<sup>1</sup>, Boutin Stan<sup>2</sup>

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Several studies have shown that the direction and strength of selection on personality varies among years, and may depend on environmental conditions. Differences in resource acquisition ability and allocation may explain the seeming specialization of individuals to certain conditions, and could lead to the maintenance of variation in personality in systems with fluctuating resource abundance. We investigated this question in female North American red squirrels in Yukon, Canada, by measuring their juvenile growth rates in years of low and high food abundance. We used random regression models to determine whether there was variation in the plasticity of juvenile growth rates related to the mother's personality. We found that more active females were more plastic; they had particularly low growth rates at low food abundance, and particularly high growth rates at high food abundance. More active females are therefore more sensitive to changes in cone abundance. They may have high resource acquisition ability, but require food to be abundant for success, and could therefore be considered to be high-food specialists.

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## Decision-making processes in the collective movements of Przewalski horses: Influences of the environment

Bourjade Marie<sup>1</sup>, Thierry Bernard<sup>2</sup>, Petit Odile<sup>2</sup>

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We investigated decision-making processes in collective movements by observing two families of Przewalski horses (*Equus ferus przewalskii*) in a semi-free ranging population. We aimed to identify the dynamics of movement patterns according to contexts and to examine how group coordination may be affected by environmental factors. We found that horses rarely failed to keep cohesion. Single-bout and multiple-bout movements were two distinct movement patterns observed in both groups. They were defined by the occurrence of pauses between bouts; they differed by their durations, distances covered, occurring contexts, and social coordination. In single-bout movements, individuals – alone or by subgroups – quickly followed the moves of conspecifics. In contrast, the adhesion of multiple-bout movements was longer when the number of decision-makers and priming behaviours before departure increased. Multiple-bout movements were commonly used to leave restricted access areas and switch to different activities and ecological areas, explaining that horses expressed motivational divergences through different priming behaviours. Our results showed that decision-making in Przewalski horses was based on shared consensus and that they adapted their movement patterns to the environmental context.

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## What is more attractive for ravens: to pilfer food or object caches?

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Corvids' most sophisticated skills revolve around food-caching. However, they also cache non-edible items, commonly regarded as a side effect done out of a 'caching mood'. Accordingly, object-caches should have a low incentive value for being pilfered. We here tested this assumption on ravens, contrasting the hypothesis with recent findings that ravens utilize object-caching for initiating playful interactions. Seven adult birds were allowed to pilfer human-made caches, containing preferred food, non-preferred food or an object, while manipulating the birds' hunger level and the novelty of the cached object. Ravens tended to pilfer the object cache even prior to the preferred food cache, particularly when it contained a novel item. They spent significantly longer time handling novel objects than familiar ones, and showed more interest in the objects when they were satiated. We conclude that cached objects are indeed valued by ravens and could especially in satiated contexts serve to initiate social play.

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*Notes*

**Strategic decisions during contests in the hermit crab *Pagurus bernhardus*: Physiological constraints and performance capacities.**

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Many agonistic activities should be demanding to perform, such that within the time-scale of an agonistic encounter they entail significant energetic costs. Agonistic signals, for example, may advertise aspects of the sender's performance capacity. Fighting animals may therefore base strategic decisions (e.g. 'giving up') on information about their opponent but also on the physiological consequences of performance, which may accrue during the fight. During 'shell fights' in hermit crabs, over the ownership of empty gastropod shells, the two opponents perform different agonistic activities. 'Attackers' perform vigorous bouts of 'shell rapping' in an attempt to induce the defender to relinquish its shell. Defenders remain tightly withdrawn into their shell until the encounter is resolved. Fighting has energetic consequences for both roles but the decision to give up is influenced by different energetic costs in each case and there are clear differences in hormonal changes that occur in each role. However, a wide range of physiological mechanisms may contribute to RHP. Although many examples of contest behaviour involve two distinct roles with different decision-rules, the overarching factor in determining the chance of victory may be differences in performance capacity. Therefore in addition to investigating the role of specific mechanisms we also investigate the possibility of differences in the 'whole body performance capacity' between winners and losers.

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*Notes*

## Water bathing in European starlings improves flight manoeuvrability

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Most bird species regularly bathe in water, but the function of this behaviour is unstudied. We tested the hypothesis that bathing may be important in feather maintenance and hence affect flight performance. We disrupted feather structure in a group of European starlings (*Sturnus vulgaris*) and then controlled their access to bathing water prior to assessing flight performance through an aerial obstacle course. In support of our hypothesis, we found that birds that had bathed in the three hours immediately prior to assessment hit fewer obstacles given their flight speed. We discuss the implications of this finding for the welfare consequences of denying access to bathing water in captive birds.

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*Notes*

## Personality in cooperative breeding systems

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Cooperatively breeding species provide a promising system in which to study personality. In such species, individuals typically follow one of several distinct life-history trajectories. They may either remain in their natal group, or disperse and potentially breed independently. Philopatric individuals must also choose whether to help rear the young of others in their group. These strategies are likely to involve very different selective regimes, possibly giving rise to adaptive, stable behavioural differences among individuals. Indeed, recent theoretical models have predicted that traits contributing to life-history tradeoffs will vary systematically among individuals. In particular, behaviours involved in risk-taking are expected to vary according to whether individuals invest in current or future reproduction. Thus, individuals that delay breeding by not dispersing should take fewer risks than their dispersing counterparts. Individuals may also vary consistently in their cooperative behaviour. Members of the same group are often found to differ widely in how much they help care for young. Much of this variation remains unaccounted for. Consistent differences in helpfulness might arise if investment in helping causes a reduction in residual reproductive value. Therefore, individuals with greater future reproductive potential may not only be less likely to take risks, but may also be less helpful. Hence, cooperative behaviour may itself be part of a behavioural syndrome.

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## On the evolution and stability of mutualisms

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Interspecific mutualisms are an essential feature of life on earth. Despite their importance for species diversity, community structures and agricultural revenues, we still know little about their evolution and stability. For a thorough understanding of the conditions that promote stability, we need to know the natural history of study systems in order to describe the game structure of interactions: do partners invest, do players interact repeatedly, is there partner choice, etc? I will present a framework that links game structures to corresponding partner mechanisms like sanctions, punishment or partner switching. Control mechanisms may induce the partner to cooperate in order to gain rewards or to avoid repercussions. Regarding the evolution of mutualisms, I propose to make use of the apparent variability between species that play the same role ('protectors', 'transporters', 'food providers') with respect to their level of adaptation to fill that role. A comparative approach may use this variation to infer both the initial state of a given type of mutualism and the direction it is taking. I will illustrate my points with data on marine cleaning mutualism, where so-called 'cleaners' remove ectoparasites and mucus from so-called 'client' reef fish

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## **Environmental and genetic control of the avian song system**

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Sexual selection acts directly on the morphology of the avian song system, which controls song structure and the rate of song production in songbirds. In particular, HVC size has been shown to relate to song complexity, both across and within species. However, the avian song system is also vulnerable to environmental effects and morphological changes during development, according to early developmental conditions. Here, we review the evidence for the heritability of the song system and show that whilst there is clearly a strong genetic component to the development of the song system, environmental conditions need to be controlled to quantify heritability accurately. We present data from our own studies quantifying the environmental impacts on neural development in zebra finches and starlings.

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## Scintigraphy of a social organisation: the dynamic of food flow in an ant colony

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The behaviour of food sharing is vital for a large number of species either solitary or social and takes a particular importance within highly integrated societies. In spite of its importance the spreading of foraged food inside an insect society has been subject to few studies and the previous works mainly focused on the final repartition of the food within the colony. Using scintigraphy, a method borrowed from medical imaging, we were able to describe the food flow in a dynamic way. We monitored the spreading of a radiolabelled sucrose solution inside a nest of *Formica fusca*. Our results show that, from the very first load that has entered the nest, the food already present in the colony acts as negative feedback on the entering food flow. After one hour of experiment, 70% of the total amount of food has already entered the nest. The total quantity foraged is close to 4 times smaller than the expected storage capacity.

A finer study of the spatial repartition of the food shows that although all ants have been fed 30 minutes after the beginning of the experiment, a small area representing in average 8% of the radioactive surface holds more than 25% of the stocked food. Remarkably, the position of the centre of this high intensity surface remains stable during the three hours of experiment.

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## From disorder to order in locust hopper bands

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Despite huge differences in the scale of animal aggregations and the individuals' cognitive abilities, similarities in the patterns they produce have suggested that general principles may underlie collective motion. Recent models of Self-Propelled Particles (SPP) have predicted that moving groups may share group-level properties irrespective of the type of animals implied. One key prediction is that as the density of animals in the group increases, a rapid transition occurs from disordered movement of individuals to highly aligned collective motion. By studying locust groups in laboratory and field experiments, we were able to confirm the prediction of a rapid transition from disordered to ordered movement and identify a critical density for the onset of coordinated marching in locust nymphs. In the field, Australian plague locust bands have a very distinct structure characterized by an absence of clear edges and extreme density gradients, with the back of the band falling below the critical density where cohesion is lost and locusts potentially solitarize. SPP models predict that these characteristics have strong consequences on the daily activity and trajectories of locusts. Studying band dynamics through the interplay of modeling, laboratory and field experiments will help to improve prediction and control of migrating insect pests such as locusts, and to understand how animal groups in general form complex patterns, avoid predators, forage, and make decisions.

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**Fear-related behaviors to predator odors :  
comparison between 2,4,5-trimethylthiazoline (TMT) and natural fox feces in mice.**

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Fear is a neurobehavioral response induced by several threatening stimuli and an important adaptative system in a majority of animal species. In natural environment, preys can detect predator odors through different sensory pathways, especially olfactory stimuli. Over the last decade, a variety of experimental studies have used pure synthetic TMT, as a component of red fox odors to induce unconditioned fear. In order (1) to compare responses induced by TMT and natural fox feces odor (2) to investigate the respective part of olfactory (CN I) and trigeminal (CN V) nerve during TMT exposure, two experiments were conducted (Buron et al., 2007\*), using a corridor-shape maze to evaluated avoidance.

A first experiment compared the avoidance in relation to TMT concentration and natural fox feces. Results showed that the avoidance was higher with pure or 50% TMT as compared to natural fox feces.

A second experiment compared fear-related behaviors to predator odors and toluene (an irritant without ecological significance) before and after intranasal ZnSO<sub>4</sub> perfusion. Results showed that natural fox feces appeared to be pure olfactory nerve stimulant and 10% TMT a mixed olfactory and trigeminal nerves stimulant.

Taken together, these findings suggest that TMT and fox feces odors don't have the same properties of trigeminal system activation. Future studies should use concentrations lower than 10% TMT.

\* Behav. Neurosci., 121: 1063-1072.

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## Aggressive behaviour differs between resident and migratory Stonechats

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For most species territorial aggression is essential to defend resources required to survive and to reproduce. Generally, territorial aggression is regulated by the androgen hormone, testosterone (T). However, most studies have been conducted during the breeding season, when T concentration is elevated; nevertheless several vertebrates are aggressive also during the non-breeding season, when T levels are low or even undetectable. So far only few studies, mainly in birds, have compared the hormonal control of aggressive behavior between seasons and contradictory results have been obtained. A review of these studies suggests that there are different patterns for resident and migratory birds. In this work we studied whether there are differences between migratory and resident birds in the hormonal control of territorial aggression. We compared the aggressive response between resident and migratory stonechat (*Saxicola torquata*) populations before and after simultaneously blocking of androgen-receptors and aromatase activity. Our results show that during the breeding season aggressive behaviour is T-dependent in both populations. However, migratory birds are more aggressive than resident ones. Moreover there are strong seasonal changes in aggressive behaviour in migratory birds but not in resident populations. Our work indicates that being resident or migratory influence territorial aggressive behaviour.

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## Energy metabolism and animal personality

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Although basal metabolic rate (BMR) is measured under highly standardised conditions, it consistently varies markedly both within and between species. A large proportion of BMR variance is still unexplained, making its functional significance yet unclear. In this presentation I will show how inter-individual and inter-specific variation in BMR should be associated to animal personality and argue that knowing the energetics of different behavioural types will help understand how personality and life-history traits coevolved. I use a comparative dataset on exploratory behaviour of rodents to illustrate linkages between personality, energetics, life-history, and phylogeny. First, superficial explorers start reproducing earlier than thorough explorers. Such a finding offers support for a central assumption to an evolutionary model that cogently explains how personalities evolve through natural selection. Second, I show how BMR negatively relates to both age at first reproduction and exploration. Superficial explorers had higher BMR than thorough explorers. Therefore, a superficial exploration strategy is associated to a “fast” pace of life through the maintenance of a high BMR. Finally, I show how exploration and BMR exhibit a strong phylogenetic signal. *Microtus* sp are all superficial explorers with high BMR whereas *Peromyscus* sp are thorough explorers with low BMR. These contrasting strategies may have evolved in response to environmental productivity and predictability.

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## **Revisiting host manipulation by parasites**

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Many parasites with complex life cycle bring about phenotypic changes in their intermediate hosts that appear to enhance trophic transmission to final hosts. Host manipulation by parasites is regularly cited as a convincing example of extended phenotype, although the adaptive nature of the phenomenon remains debatable. In particular two aspects need further consideration. On the one hand, it has often been taken for granted that for manipulation to evolve, it had to increase specificity in trophic transmission. However, this might not be mandatory. In particular, reducing the probability for a parasite of dying in its host before any predation event occurs might be sufficient for host manipulation to be adaptive, as will be shown from a simple graphic model. On the other hand, the adaptive nature of host manipulation has been tied to the complexity of the mechanisms involved. However, research on the underlying mechanisms of host manipulation by parasites remain scarce. Here I outline some criteria by which the adaptiveness of host manipulation could be assessed from the study of physiological mechanisms.

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## **Predator recognition by fishes: from simple learning to complex generalization**

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While some prey species possess an innate recognition of their predators, others require learning. The specific characteristics of predators that prey learn and whether prey can generalize this learning to similar predatory threats have been virtually ignored. Here, we investigated whether fathead minnows that learned to chemically recognize a specific predator species as a threat, have the ability to generalize their recognition to closely related predators. In our first experiment minnows trained to recognize the odour of lake trout as a threat (the reference predator), generalized their responses to brook trout (same genus as lake trout) and rainbow trout (same family), but did not generalize to a distantly related predatory pike or non-predatory suckers. The purpose of our second experiment was to test whether this generalization of predator recognition was dependent on the level of risk associated with the known predator. Minnows conditioned to recognize brown trout as a high threat generalized their recognition to rainbow trout (but not to distantly related perch), while those conditioned to recognize brown trout as a mild threat failed to generalize their recognition to any other species. We provide a theoretical framework for future studies of generalization of predator recognition.

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## **Behavioural syndromes in specialist-generalist species**

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Specialist species of very different taxa have been affected by global change. Thus, an urgent challenge for scientists is to improve our understanding of the specific behavioural traits that characterize specialist species. Recently, a growing literature on behavioural syndromes has pointed out the limits of plasticity behaviour and we hypothesize that a link between specialisation and limited behavioural plasticity exists. We observed phenotypic differences between specialist and generalist bird species in exploratory behaviour, in latency to eat food and breathing rate. Generalists are more explorative, less neophobic and less stressed than specialists. And we found that only specialist species had a behavioural syndrome, i.e activity is positively correlated with stress behaviour. We discuss the possible implications of behavioural specialisation in human modified environments.

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## The hippocampus in homing pigeons is affected by experience

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Homing (racing) pigeons (*Columba livia* f.d.) are well-known for their homing abilities, which are based on a genetical predisposition, multimodal learning and spatial cognition. It is proven that the hippocampus, a forebrain structure that processes spatial information, is larger in homing pigeons compared to other non-homing pigeon breeds. Here we show that this characteristic hippocampus volume is dependent on flying and navigation experience.

20 homing pigeons originating from the same breeding stock were raised in the same loft under identical constraints. After fledging, 10 of them were allowed to fly around the loft, gain navigational experience and participated successfully in races. The other 10 stayed permanently in the loft and thus did not share the experiences made by the first group. After reaching sexual maturity, individuals of both groups were sacrificed and morphometric analyses were carried out to measure the volumes of total brain, telencephalon, hippocampus and 12 other brain structures. Individuals with experience of flying and navigation had a 12% larger hippocampus relative to the telencephalon compared to non-experienced individuals ( $p=0.026$ ). This effect is not seen in one of the other measured brain structures.

Surely the navigational ability of homing pigeons has a genetical basis since it results from selection and animals breeding. However, our results confirm that the genetical potential is only fully developed if it is demanded by experience.

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## The effect of environment on spatial clustering and activity levels in laying hens

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We may expect the environments in which we house laying hens to have an impact on group dynamics and activity levels. Twelve groups of four hens were tested in three environments – wire floor (W), shavings (Sh) and perch, shavings, nestbox and peat (PPN). Groups experienced each environment twice, for five weeks each time, in systematic order. Video recordings were made one day per week in every pen, for all of the 30 week experiment. We recorded positional data from a randomly selected 20-minute excerpt from each video. On screen, pens were divided into areas. Every five seconds, the area that each bird was in was recorded. Clustering score was calculated for each five-second recording as the maximum number of birds in an area divided by the number of occupied squares. Scores were averaged per video and tested using general linear mixed models. Activity levels were calculated from the sum of the transitions made per bird between squares over the 20 minute observation period. Overall, groups showed a high level of clustering and there was a highly significant effect of perch and nestbox presence on clustering score ( $F_{1,237}=14.83$ ,  $p<0.005$ ), with groups clustering less in PPN than W and Sh. There was also a significant effect of floor type ( $F_{1,255}=6.52$ ,  $p=0.011$ ) - groups housed in Sh clustered most. Activity levels were lower in PPN compared with W and Sh environments ( $F_{2,109}=14.61$ ,  $p<0.001$ ). The implications of these results for animal welfare will be discussed.

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## Consensus decisions in animals

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A consensus decision is when the members of a group choose, collectively, between mutually exclusive actions. Groups can reach consensus in a manner between two extremes. First, they can make decisions democratically or equally shared, that is without leadership: all group members contribute equally to the decision outcome. Outcomes are determined by majority vote, or similarly. Second, groups can reach consensus by a despotic or unshared leadership: one particular group member (the leader) makes the decision, and all others abide by it. In between these two extremes, decisions can be made more or less shared, with a more or less strict leadership, depending on how many members contribute to the decision outcome. In humans, consensus decisions are often shared. Biologists are only now realizing that shared decisions also occur in many social animals. However, sharing of decisions is not profitable for all group members, posing a question as to how it can evolve. Using a game theory model, I show that it can evolve under a wide range of circumstances, but especially when: groups are heterogeneous in composition; alternative decision outcomes differ in potential costs; costs are large; grouping benefits are marginal; or groups are close to optimal size. Since these conditions are commonly met, mechanisms for shared decision making can easily arise, including in early human ancestors.

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## **Personality traits and individual's ability to invade**

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Biological invasions are gaining attention as a major threat to biodiversity and an important element of global change. Recently, many researchers have pointed out the need for a better understanding of the behavioral mechanisms of invasion success. While previous studies focused on behavioral mechanisms of invasiveness across species, individual variation in ability to invade within a given species has not been studied. Which individuals leave their population to invade new habitats is however a crucial question in biological invasions. I will show how personality traits underlie dispersal tendencies and ability to invade of an invasive fish. In particular, some environmental conditions in a source population lead to the dispersal of individual with specific personalities and with increased preference for empty habitat. These results highlight the importance of characterizing the behavioral types of dispersers and the variation in dispersal decisions among members of invasive species.

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## **The mechanism and evolution of collective decision-making in animal groups**

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Collective organization is everywhere, both around us and within us. Our brains are composed of billions of interconnected cells communicating with chemical and electrical signals and we ourselves are integrated in our own collective human society. Elsewhere in the natural world hundreds of thousands of blind army ants coordinate a massive raid across the rainforest floor, a flock of birds arcs and ripples while descending to roost and a fish school convulses, as if one entity, when attacked by a predator. How can animal groups make the rapid collective decisions required to move in unison? How does individual behaviour scale to group dynamics? How and why do animal societies make informed unanimous decisions? From ant swarms to flocking birds, from consensus decision-making in fish schools to that among humans, I will discuss how, and why, coordinated collective patterns are generated in biological systems.

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*Notes*

## **Nocturnal acoustic communication strategies: convergence and divergence in two sympatric seabirds**

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Shearwaters are nocturnal burrowing seabirds. They return to their colony at dusk and exhibit high vocal activity, underlining the usefulness of acoustic cues to nocturnal communication. Our aim was to test whether acoustic communication systems of two sympatric shearwater species, the Yelkouan shearwater *Puffinus yelkouan* and the Mediterranean Cory's shearwater *Calonectris diomedea diomedea*, converge to similar strategies. Inter-annual mate fidelity and incubation relays led us to focus on sex and individual acoustic signatures. For both species, we first characterized these two signatures by analysing the major call emitted by incubating birds. Secondly, we performed playback experiments to assess the ability of birds to vocally discriminate between sexes and mate versus non-mate. Results showed that both species use a reliable sex vocal signature supported by frequency and energy features, enabling sex identification of the emitter. By responding only to conspecific same-sex calls, birds may ensure burrow and mate guarding. Conversely, individual vocal signature was mainly supported by temporal parameters, and was more reliable in the Cory's shearwater. Moreover, this species use vocal exchanges to identify the mate during incubation relays, whereas Yelkouan shearwaters probably need additional cues. In conclusion, we observe an evolutionary convergence in intra-sex communication process but a divergence in mate greeting strategy.

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## Coincident disruptive coloration

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Disruptive patterning is widely used in camouflage. High contrast colour patches create false contours within the body as opposed to at its periphery. In his classic account of animal camouflage, Cott (1940) noted that discontinuities at the body's edge are not the only clues to the presence of a cryptic animal; other salient features such as eyes and limbs must be concealed. He proposed that strategic placement of disruptive patterns, such that patterns are spatially coincident across adjacent body parts, would cause limb to blend with body, eye with face, and so salient features would become unrecognisable. Given that there is no developmental necessity for colour patterns on disparate body parts to match, his arguments provided strong evidence for the adaptive value of coloration at a time when Darwinism was under threat. However, perhaps because of this persuasive logic, Cott's principle of Coincident Disruptive Coloration has never been tested. Using artificial moth-like stimuli with two-tone coloured 'wings' and edible two-tone bodies, we show that coincidence of coloration across wing and body significantly reduces detection by wild birds in the field. We experimentally separate two contributions of the body-wing pattern coincidence to concealment: match of the body to its wing 'background', and the disruption of form central to Cott's hypothesis. We also present data from human experiments replicating these results under controlled viewing conditions.

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## Personnality and sexual selection

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Despite burgeoning evidence for personality differences across the animal kingdom, their evolution and maintenance remain largely unexplained. Recently, ecologists have started to develop functional explanations for such consistent individual differences in behaviour. Despite this effort, the role of sexual selection has not yet been systematically considered. In this context, we discuss the maintenance of both key aspects of animal personality, intra-individual consistency and inter-individual variation. Our goal is to begin to develop a framework for considering how sexual selection can maintain of personality differences across a wide range of social and mating systems.

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*Notes*

**Utilization of two sympatric sea-urchin host species by the ectoparasite pea-crab,  
*Dissodactylus primitivus***

**De bruyn Colin C.<sup>1</sup>, David Bruno<sup>2</sup>, Rigaud Thierry<sup>2</sup>, De ridder Chantal<sup>3</sup>**

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Classical studies of host-parasite evolution have been concentrated on single-species host-parasite systems. However, it has long been known that many parasites with direct life-cycles have multiple concurrent host species and, to understand the evolution of host-parasite systems, biologists need to address these more complex interactions. Among brachyuran crabs, the Pinnotheridae (“pea crabs”) count mostly symbiotic species. Among them, species of the *Dissodactylus* complex are exclusively associated with irregular echinoids. This work explores the way the parasitic species *Dissodactylus primitivus* utilizes two sympatric host species (*Meoma ventricosa* and *Plagiobrissus grandis*) in Discovery Bay (Jamaica), with the aim to understand why and how the parasite exploits two hosts. The entire life cycle of *D. primitivus* is realized on *M. ventricosa*, indicating this host is probably the primarily host. Only adult crabs are found on *P. grandis*. Female crabs are larger and more fertile on this host. Choice experiments (both in aquaria and Y-tubes) indicate that neither the adult nor the juvenile crabs are preferentially attracted by one of the host species. We advance that *P. grandis* is a host species recently “captured” by *D. primitivus* because it provides a more favorable reproductive site than *M. ventricosa*. We propose that this peculiar life cycle could be a step toward a complex life cycle with two successive hosts.

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## Coping strategies on rainbow trout: flexibility and distractability

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The rainbow trout has become something of a model system for studies of coping strategies in fish on the basis of two lines selected for breeding for low (LR) or high (HR) post-stress plasma cortisol response. In addition to striking differences in cortisol responsiveness, LR and HR fish show patterns of brain biochemistry and risk-taking and aggression personalities that are typical of the proactive and reactive animals. The results reported here strengthen this comparison by comparing behavioural flexibility and distractability (two other traits that differentiate proactive and reactive animals) in 3th generation LR and HR rainbow trout. Fish from both strains were trained individually to find food in one arm of a T-maze. Once this task was learned, we recorded the effects on the ability of fish to find food of (i) a change in position of the food source and (ii) an unfamiliar object placed on the learned route to the food source. HR fish found food strikingly faster than LR trout when the resource was moved to a different position. In contrast, LR fish were much less distracted by the presence of an unfamiliar object. Previous studies have shown that proactive animals develop and follow routines more strictly than do reactive animals, while the later are more aware of changes in their environment. Our results therefore give further support to the characterisation of LR and HR rainbow trout as showing proactive and reactive coping strategies.

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## Foraging and associative learning of visual signals in a parasitic wasp

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To cope with environmental variability, animals should gather and use information to reduce uncertainty. In insect parasitoids, associative learning has been widely documented in the context of host foraging. However, despite its potential adaptive value, the insect food searching strategy and cues used to search are poorly understood. In this study, we examined the ability of hymenopteran *Venturia canescens* females to associate food to a visual cue. To broaden the scope of our results, experiments were performed with both arrhenotokous (sexual) and thelytokous (asexual) individuals. The wasps showed innate attraction for yellow and orange stimuli when presented versus blue stimuli. When trained to associate a food reward with one of the attractive colours (orange), they significantly moved from a distance towards the colour previously associated with food. The choice of the innately preferred colour (yellow) was not modified by associative learning. In the context of food foraging, this study is the first to show associative learning using visual stimuli in a parasitoid and active choice of this colour. This ability gives new insights concerning potential food sources for *V. canescens* in the field, since flowers are sugar sources, which emit colour signals.

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*Notes*

## **Parasite mediation of interspecific interactions; effects on intraguild predation and the functional response**

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Parasites are well known to manipulate intermediate host behaviour to enhance transmission to final hosts. Parasites also influence the dynamics of competition among hosts (e.g. ‘apparent competition’) and are important in biological invasions (e.g. ‘enemy release’). However, less attention has been given to the effects that parasites have on other important interspecific relationships among hosts, such as intraguild predation (IGP), and how parasites mediate the trophic ecology of hosts in a wider context, such as impacts on communities. Here, we show that parasites can alter the balance of IGP among hosts, explaining patterns of exclusion and co-existence among native and invasive species. For example, microsporidian parasites show ‘cryptic virulence’ in amphipods, the virulence only becoming apparent during IGP interactions. Further, parasites may alter the feeding ecology of hosts and thus their impacts on prey populations. For example, we show that an acanthocephalan parasite causes a higher ‘functional response’ of amphipod hosts. A challenge now is to understand which behavioural modifications are deliberate on the part of the parasite and which are side-effects of parasitism.

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## **Concealed by conspicuousness: distractive prey and background markings**

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According to a contradictory, but untested idea, conspicuous markings on a prey should make it more difficult to detect and thus improve its crypsis. Such distractive or dazzle markings have been suggested to work by directing a predator's attention away from the body form or other details to a meaningless marking. We tested this hypothesis in a predation experiment with blue tits (*Cyanistes caeruleus*) and artificial prey. We used two grey-scale backgrounds, a low contrast range (LC) and a high contrast range (HC) background, which differed only in the lightness of the darkest and the lightest of their five-shaded patterning. We used three different prey types. LC and HC prey only matched the respective backgrounds. The third prey (MB) matched both backgrounds because it lacked the extreme shades. If crypsis is simply determined by background matching, then the LC and HC prey should be the most difficult to detect on matching backgrounds and the MB prey should be equally difficult to detect on both backgrounds. However, our results show that all three prey types were more difficult to detect on the HC background than on the LC background. Furthermore, the HC prey was more difficult to detect than the other two prey types on both backgrounds, although it did not match the LC background. In conclusion, our experiment lends support for idea that highly-contrasting distractive markings, both as part of prey coloration and in the background, can make prey detection more difficult.

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**Ecological conditions favouring  
the evolution of behavioural syndromes**

**Neil Dingemanse**

Abstract not received

## Social recognition related to Arginine Vasotocin system in juvenile sea bass (*Dicentrarchus labrax*).

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Juvenile sea bass *Dicentrarchus labrax* were tested for congener recognition ability using dyadic tests. Familiar and unfamiliar fish were allowed to interact in pairs for 5 days. After an exploration time (around 30'), aggressive interactions were measured in each pair. Familiar dyads exhibited significantly lower aggression levels than unfamiliar pairs (ANOVA,  $P < 0.05$ ,  $n = 16$ ). Each tested unfamiliar pair formed a dominant-subordinate relationship, where the dominant fish performed most of the aggressive acts characterized by a repeated pattern of intimidation, chasing and attack (ANOVA,  $P < 0.05$ ,  $n = 8$ ), whereas the subordinate exhibited an aggression suppression and a locomotor activity inhibition. Arginine vasotocin (AVT) neuroendocrine system provides integrative regulation of fish social behavior. Immunohistochemistry showed that the AVT staining pattern in brain strongly differed according to social context of fish. Unfamiliar dyads displayed significantly higher area and number of AVT-immunoreactive cells in the nucleus preopticus (nPO) and in the nucleus lateralis tuberis (nLT) than familiar dyads (ANOVA,  $P < 0.05$ ,  $n = 16$ ). Moreover, dominant fish expressed more AVT in significantly higher number of AVT-immunopositive cells than subordinates (ANOVA,  $P < 0.05$ ,  $n = 8$ ). At first, the results suggest a significant ability of social recognition in juvenile sea bass. Then, the AVT system may play a role in the regulation of both social recognition processes and in dominant-subordinate relationships in this fish species.

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## **Mental games between competitors: why beetles learn better than ants?**

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Red wood ants compete for space with other litter-dwelling predators such as carabid beetles and force them away from their territory creating “black holes” in the habitat, where intruders can be killed or injured. Our experiments demonstrated four species of carabids as being able to avoid efficiently collisions with ants. Carabids were tested in a Y-shaped maze containing an active ant leashed in one of the sections. The majority of beetles successfully avoided conflicts with ants, each applying one of a set of stereotyped tactics such as to turn away after touching the ant, to go round the ant, to stop near the ant with legs and antennae hidden, and so on. Surprisingly, a great part of ants displayed a completely “dull” behaviour being tested in symmetrical situations (the maze containing a biting beetle leashed in one of the sections). Is it possible that beetles learn better than ants? Developmental experiments revealed that some red wood ants possess the inherited “enemy image” based on specific features of carabids. Testing representative of different functional groups within ants’ families we demonstrated that “guards” and “hunters” exhibit the highest level of aggressiveness together with the clearest image of the enemy expressed early in ontogeny. Aphid milkers have a tendency to avoid dangerous objects. It is likely that aggressive ants are hereditarily incapable of learning to avoid danger, which may be related to cognitive specialization within ants’ family.

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## **Constraints to the evolution of animal cooperation among unrelated individuals**

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Reciprocal altruism, which represents the most probable explanation for cooperation among non-kin, has been modelled as a Prisoner's Dilemma. According to this game, cooperation could evolve when individuals, who expect to play again, use conditional strategies like Tit-For-Tat or Pavlov. Over the last four decades, this paradigm has been exploited with great success by theoreticians, but most experimental studies with non-human animals have failed to find cooperation in controlled payoff games. The most frequently proposed explanations to these failures state that animals do not maintain high levels of cooperation in an Iterated Prisoner's Dilemma (IPD) game because they either systematically give in to the short-term temptation of cheating when long-term benefits exist or do not have the cognitive abilities required to adopt complex conditional strategies. A more simple explanation for the fragility of cooperation in the IPD would be that animals fail to cooperate because they expect that their chances of encountering the same opponent later are so low that they behave as if they were to play only a single round of the game. To assess the importance of these potential constraints, we conducted laboratory experiments with zebra finches and manipulated both the degree of uncertainty of future play and the memory capacities of the subjects. I will discuss the implication of the obtained results.

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## Do female Siamese fighting fish copy the mate choice of others?

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Choosing the right partner may be a difficult task. Therefore, observing the choice of another individual in order to copy its decision is an option which may have lower costs and present additional benefits. Mate choice copying has been documented in several species, including fish such as sailfin mollies and guppies. Female Siamese fighting fish (*Betta splendens*) have been reported to eavesdrop and exploit social information in aggressive interactions and may therefore also use information contained in other's mate choice. In this experiment, we aimed at establishing if female fighting fish copy the mate choice of others. We examined if the initial choice of a female between two males can be changed by observing another female with the previously rejected male. The two males and the model female(s) were exposed in different settings to the female subject to test the relative effects of mere association and active courtship behaviour. We also recorded and analyzed the effects of male body size, colour and behaviour on the subjects' responses. Our experiments provide a detailed analysis of the interplay of male properties and female independent and dependent mate choice strategies.

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## Overlap of interaction types and seasonal changes – between competition and interference

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Interaction types such as competition, interference and predation may not show textbook distinctions in real-world species interactions. The type of interaction in a given species system may change with the season investigated or with the focal life-history stage monitored. Here we report on a two-species pair of voles (Arvicolidae), investigated in a series of experiments on different life history stages of experimental animals and in different seasons. Animals were kept in one-species or two-species large outdoor enclosures. Populations and individual behaviour were monitored. The subordinate species, the bank vole, interacts aggressively with the dominant species, the field vole, during summer. Home range sizes and survival rates are reduced in enclosures with a competitor species. The summer-born, younger and smaller bank vole females carry the costs of this interference, while over-wintered, larger and older females were not affected. During winter, the interaction between the species is not aggressive and enlarged home ranges suggest strong resource competition. Our study system clearly illustrates how strengths and type of interactions can be variable in given species systems.

**Starve the mother, kill the babies:  
mechanisms of reproductive skew in burying beetles**

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Burying beetles (*Nicrophorus vespilloides*) inter small vertebrate carcasses and use them as a food source for their developing young, which they feed and defend from predators. Breeding associations can range from single females and monogamous pairs to groups with multiple males and females. In brood-parasitic associations, which are characterized by a clear dominance relationship between females, the dominant female monopolizes access to the carcass. Subordinates lay eggs and frequently have one or a few offspring in these associations, but dominants contribute 80% or more of the total brood. Differential fecundity, differential ovicide and differential larvicide have all been proposed as possible causes of this severe reproductive skew. We investigated the role of each of these potential mechanisms in laboratory experiments. We fed females different dyes prior to giving them access to a carcass, which enabled us to discriminate between the two females' eggs. We found differences in fecundity that were due to differential access to carrion. Larvicide also contributed to reproductive skew, while differential ovicide did not. Apparently, dominant females minimize subordinate egg production by denying them access to the carcass, and they also use a temporally based, offspring-recognition mechanism to selectively kill subordinate first-instar larvae.

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## Interference and predation in a vole-shrew study system; effects and seasonal variation

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Interspecific competition plays a major role forming and regulating species assemblages and is highly dependent on the type of competitive interaction occurring. Besides indirect negative interactions due to exploitative competition, also direct interference and predation are important factors shaping species coexistence. These interaction types are often overlapping and may also vary with season and life history stage, therefore induced effects are not easy to separate. We studied impacts of interference and predation by common shrews (*Sorex araneus*) on lactating bank voles (*Myodes glareolus*). These species partially overlap in their diet and may interact aggressively in their common habitat. Additionally, shrews can prey on nestling voles. Experiments were conducted in outdoor enclosures in two different seasons (summer and autumn). To test whether the presence of competitors or nest predators induce behavioural adaptations, we investigated lactating bank voles spatial and foraging behaviour. Further we focused on fitness costs, e.g. offspring survival, bank voles may experience in the presence of shrews. Interference took place in summer for voles decreased their home ranges, spent more time outside the nest and altered foraging behaviour. In autumn we found decreased offspring survival indicating nest predation by shrews. Different food availability and temperature in the two seasons may be the reasons for the shift of interaction types.

## **Variable assessment rules in aggressive contests**

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The idea that each contestant assesses its own fighting ability/state and compares it to that of their opponent was widely accepted as the norm. However, the typical test used to indicate this mutual assessment was unable to exclude own size/state assessment (Taylor & Elwood 2003). Once this was realised, and tests proposed to discriminate between the two main hypotheses, various studies showed that some animals used mutual and others own size assessment. However, yet other studies have indicated that a) assessment abilities differ for the two contestants, b) that there may be good ability to assess own size but only partial ability to assess the opponent or c) that the mode of assessment changes during the contest. Here I explore these possibilities within a context of information gathering and decision-making. The studies to date demonstrate varied abilities make it clear that new models are required to explore the constraints that animals face in obtaining effective information.

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## Personality matters: individual variation in reactions of naive bird predators to aposematic prey

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Variation in reactions to aposematic prey exists among individuals of the same predator species. In adult birds, the variation could be a result of different experience but differences in reactions exist also among naive birds. Attitude to a novel (especially aposematic) prey may be linked with the personality of an individual - a complex of heritable correlated traits including exploratory behaviour, aggression, risk-taking, boldness, etc. Personality traits have been extensively studied in great tits (*Parus major*), in which two types are defined: “Fast” exploring individuals that are bold, aggressive, and routine-forming; “slow” exploring individuals that are cautious, non-aggressive, and innovative. In naive, hand-reared great tits we tested the influence of personality type on (1) degree of unlearned avoidance, (2) rate of avoidance learning, and (3) memory of the experience with aposematic prey. We used birds from two lines selected for different personalities and subjected them to the sequence of trials, in which they were offered aposematic red-and-black adult firebugs (*Pyrrehoris apterus*). Slow birds showed greater degree of unlearned avoidance, and they learned to avoid the firebugs faster than did the fast birds. Both groups remembered their experience equally well to the next day. Populations of predators, which differ in the composition of personality types, could have different impact on aposematic insects. The study was supported by CSF grant 206/07/0507.

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## Group decision making in fish shoals

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Animal groups are often required to achieve consensus, whereby all individuals abide by a single action. If consensus cannot be attained then the benefits of the current group membership will be forfeited. The aim of this investigation is to demonstrate the behaviour of Mosquitofish *Gambusia holbrooki* shoal in a choice scenario wherein a consensus decision is a possible outcome. When presented with mutually exclusive choices, does the shoal split or remain cohesive and how do individuals respond in this scenario? To this end, first the fish were conditioned to approach a red LED within ten shoals of twelve individuals in a large circular tank. A strong conditioned response by shoal members was achieved in 3 to 4 days; in the final training bout all individuals initially turned and then swam quickly towards the LED. In the same tank, the fish were introduced to a choice test, two diametrically opposing LED's. Training and choice tests were captured on video and individual movement was analysed. Further, each fish was individually tagged and screened for boldness and morphology. In this talk I will present findings that relate individual response variables to their training and choice test performance.

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## Father – offspring resemblance predicts paternal investment and offspring condition in humans

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In species with paternity uncertainty and paternal care, evolutionary theory suggests that kin recognition mechanisms should evolve. However, studies showing that males assess their paternity using phenotype matching are rare. In humans, where paternity uncertainty influences levels of paternal investment, fathers are expected to discriminate between their children on the basis of phenotypic similarities and to allocate resources accordingly. Using a polygynous population of rural Senegalese, we examined: (i) father-offspring resemblance; (ii) father investment in offspring; and (iii) the consequences of differential investment of paternal resources for child development. First, we showed variation in father resemblance between offspring. Second, we found that both face and odor similarities between fathers and children are positively related to paternal investment of resources in their offspring. Finally, we found that such discriminative paternal investment is positively linked to child nutritional condition. This is the first evidence, from a natural human population, that fathers use phenotype matching, independently of familiarity, to assess their probability of paternity, and that this affects their investment level in each child. We demonstrate that differences in phenotypic resemblance between fathers and offspring have downstream effects on fitness-related traits in offspring leading to positive selection on offspring to resemble their fathers.

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## Previous experiences shape optimal mate preferences

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Existing models of mate choice assume that individuals have perfect knowledge of their own ability to attract a mate and can adjust their preferences accordingly. However, real animals are typically uncertain of their own attractiveness. A potentially useful source of information on this is the feedback from previous encounters with potential mates. We constructed a dynamic model of mutual mate choice in which both males and females are initially ignorant of their own attractiveness. Individuals sequentially sample potential mates and retain some simple information about the outcome of these encounters (e.g. the number of times they are accepted or rejected). The evolutionarily stable strategy (ESS) we find is one in which individuals are sensitive to this previous experience, adjusting their mate preferences according to the interest received from the opposite sex. In general, experiences of rejection tend to reduce choosiness while experiences of acceptance tend to increase it. This response is favored even when individuals have some prior estimate of their own attractiveness, providing that estimate is not perfectly accurate. Sensitivity to previous experiences allows individuals to exercise a prudent mate-choice strategy in which their preferences are gradually tuned to their prospects on the mating market. We are currently testing the predictions of our model in common gobies and humans, by experimentally manipulating the level of interest shown by potential mates.

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## Out of sight, but not out of mind; Behavioral coordination in pair-living sportive lemurs (*Lepilemur ruficaudatus*)

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Many animals are organized into social groups that differ in size, composition, permanence and cohesion. In order to maintain group cohesion, individuals need to synchronize their activities. A recent model predicted that in a pair of animals, each of which chooses between resting and foraging to maximize its own survival, individuals should synchronize their activities when there is an advantage of foraging together. As a result of this synchronization, difference in the energetic reserves of the two players spontaneously develop and the individual with lower reserves emerges as a ‘pace-maker’ of synchrony. Here, we explore whether nocturnal red-tailed sportive lemurs, who live in dispersed pairs, synchronize their activities. We observed 8 pairs continuously for at least one annual reproductive cycle in Kirindy Forest, western Madagascar. One observer followed the female and another observer followed the male of a pair simultaneously. By using instantaneous sampling we recorded the exact location and behavioral state, such as resting, foraging and locomotion of the focal animal every 5 minutes. Although red-tailed sportive lemurs moved mostly solitary throughout their territory with an average distance of about 43 m between pair partners, synchrony of activities was above chance level. We will discuss the influence of distance between pair-partners, nightly activity pattern and season on the fine-tuning of intra-pair behavioral synchronization.

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## Leadership and conflict in the movements of plains zebra (*Equus burchelli*)

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Animal group movements emerge from the interactions of individuals – each of whom may have a different idea of where is best to go. In many species, movement preferences are expected to vary depending on sex, reproductive status, and other phenotypic traits. Social relationships may further influence movement choices. We examine the movements of plains zebra (*Equus burchelli*), a long-lived, highly social mammal. Plains zebra form stable harems, which come together with other harems to form fluid herds. At both social levels, we begin by asking how movement patterns depend on the sex and reproductive status of the individual initiating the move. Zebras may respond more readily to the movements of certain group members, for example those with whom they share more in common. We investigate which characteristics predict how many followers an initiator will gain. Groups may also experience conflict between members about desired movement direction. To investigate this possibility, we compare the consonance in direction of successive moves led by the same individual, by individuals who are phenotypically similar, and by individuals who are phenotypically different. We also look at the group level to investigate whether group homogeneity facilitates more efficient movement patterns.

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Notes

## Temporal organization of bi-directional traffic in ants

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Collective foraging in ants is generally organized along well-defined trails that support a bi-directional flow of outbound and nestbound individuals. If ants forage optimally one would expect that they should be able to maintain in most circumstances a flow intensity close to the maximum flow that can be supported by the trails, i.e. their capacity value. We tested this hypothesis by examining the effect of trail width on the organization of traffic. We chose two species of ants (*Lasius niger* and *Atta colombica*), differing in their degree of polymorphism and their mode of food transport. In our experiments ants had to cross a bridge to go from their nest to a food source. Two types of bridges were used: large bridges and narrow bridges. Traffic counts at regular intervals show that foraging efficiency was maintained, and even enhanced in the case of *Atta colombica*, on narrow bridges compared to large bridges. This was due to a change in the temporal organization of the flow: when path width decreases a desynchronisation of inbound and outbound flow was observed, i.e. the formation of alternating clusters of inbound and outbound ants. Close observation of the ants' behavior show that this organization emerges through the implementation of priority rules between ants which allows to minimize the amount of head-on encounters between workers. Interestingly, this phenomenon presents a striking comparison to vehicles moving on highways or to pedestrians crossing a corridor.

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Notes

**Variation between parasite families in the behavioural manipulation  
induced by the acanthocephalan *Pomphorhynchus laevis*  
in *Gammarus pulex***

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Numerous parasites with complex life cycles are able to manipulate the behaviour of their intermediate host in a way that increases their trophic transmission to the definitive host. *Pomphorhynchus laevis*, an acanthocephalan parasite, is known to reverse the phototactic behaviour of its amphipod intermediate host, *Gammarus pulex*. However, levels of behavioural manipulation exhibited by naturally-infected gammarids are extremely variable. To investigate potential sources of this variation, we carried out controlled experimental infections on gammarids, using different families of *P. laevis* from the same population. We measured different life-history traits of the parasite and a variation between families was observed for infectivity and host behavioural manipulation (phototaxis) when the parasite just reached the infective stage (young cystacanth). This could suggest that a part of this variation may be due to different genetic backgrounds. Moreover, we found an overall negative correlation between the infectivity and the intensity of manipulation, suggesting a trade-off between the two transmission stages of the parasite. Finally, we found no variation on the behavioural manipulation induced by older cystacanths. Indeed, behavioural manipulation was very strong whatever the parasite family. We therefore suggest that natural selection may act on the rapidity with which the manipulation can occur during parasite development, instead of its intensity.

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*Notes*

**All for one or a few for all? Decision-making  
in house hunting ant colonies.**

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Colonies of rock ants (*Temnothorax albipennis*) sense quorums to collate individual assessments of potential nest sites into collective decisions. Nevertheless, all of the primary fact-finding and assessments that begin to commit a colony to a choice involve workers acting alone. For example, individuals can “score”, and directly compare, the combined qualities of alternative new nests. Moreover, almost all colonies can choose a good nest 4 times further away than a collinear poor one; often almost immediately redirecting their emigration from the nearby nest to the distant one. Most remarkably, the same tiny minority of ants that first discovered the poor nest, and began recruiting to it, later first discovered the distant better one. So just a few individuals decide on one nest, recruit to it and then search for, select and switch recruitment to the better one, just as the emigration starts. Why do these individuals act as leaders? One possibility is that it is easier and quicker to assess an empty nest than a partly occupied one. Hence, the pioneers that first found the poor nest may be the ants most able to make comparisons. They alone might best serve their colony by looking for something better, rather than continuing to recruit to their first choice. So the well informed can become even better informed and play the role of political activists.

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## The Evolution of Warning Signals in Response to Mimicry

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Prey that are profitable for predators to attack tend to be cryptic, and prey that are unprofitable to attack tend to be conspicuous. Why have such conspicuous traits been selected for in populations of unprofitable prey? The conventional warning signal theory assumes that warning signals have evolved to exploit pre-existing receiver responses towards conspicuous appearances. Here we examine an alternative theory that conspicuousness evolves in unprofitable prey to distinguish them from Batesian mimics. We present the first model to allow for both mimicry dynamics, and for the evolution of conspicuousness and crypsis. Batesian mimics are generally expected to keep up with changes to an unprofitable species' appearance in dimensions that are independent of conspicuousness. However, they are unable to keep up in dimensions related to conspicuousness, as bright colourations are more costly to profitable prey than to unprofitable prey. Unprofitable species therefore evolve conspicuous warning signals to disengage from their Batesian mimics.

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*Notes*

## The law of supply and demand explains changes in the experimentally altered market values of low-ranking vervet monkeys

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In primates grooming can be exchanged against grooming, but also against other goods or services, lending it currency-like characteristics. Commodities 'bought' with grooming include tolerance at food sites (Henzi et al. 2003; Waal 1997; Barrett et al. 2002), access to newborns (Henzi and Barrett 2002; Gumert 2007a), compliance of females (Gumert 2007b), and support in conflicts (Watts 2000, 2002; Hemelrijk 1994; Koyama et al. 2006), albeit that results on grooming-support exchanges have been mixed (Silk et al. 2004; Hemelrijk and Ek 1991; Schino 2007; Schino et al. 2007). The value of some commodities, such as support, tolerance and restraint aggression, depends on the rank of the individual offering it: lower rank equals lower value. We experimentally increased the market value of several low-ranking females in two groups of free-ranging vervet monkeys by allowing them to open containers with food they could share with their group members. The experiment went through three phases with no producers (phase 0), a single producer (phase 1) and two producers (phase 2). In general the grooming rates changed in favour of food providers showing that grooming is used to 'pay' for commodities received. Sudden changes to the disadvantage of lone producers that resulted from the introduction of a second producer lead us to conclude that payments are adjusted to changes in value, confirming a central prediction of biological market theory (Noë and Hammerstein 1994, 1995).

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**Kea (*Nestor notabilis*) do not use tools during natural foraging but spontaneously develop skills for doing so when tasks are offered experimentally**

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Tool use requires the establishing of spatial relations between objects. Famous examples for tool use in birds are provided by Woodpecker Finches and New Caledonian Crows that probe holes with sticks to gain access to larvae of invertebrates. A basic skill for such tool use behaviour is the insertion of an object into a hole. Ability to do so in a non-tool using bird species might unravel the proximate extras tool using species were equipped with by phylogenetic adaptation. Here, we summarize a series of studies that investigate object-inserting behaviour in kea, a non-tool using and non-food caching albeit very explorative mountain parrot of New Zealand. In the aviary, most kea insert objects into holes spontaneously even when there is no reward involved. These objects are not inserted accidentally when manipulating them near holes. Rather, birds intend to insert them. When provided with a task where food is accessible only by inserting an object into a tube, failing birds become successful after watching a conspecific's demonstration. Developmental investigations and results from field studies indicate that kea have an amazing capacity and flexibility to produce spatial relations between objects although the birds are not adapted to use tools. Kea's restricted ability to adjust the orientation of an object for inserting it indicates a crucial impact of phylogenetic adaptation of motor skills for advanced tool-use behaviour.

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## Displacement interactions in a fish school

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There has been a long series of individual-based models of interactions for gregarious fishes that were able to produce emergent schooling behaviour. Yet, none of them was based on biological measurements at the individual level.

We videotapped *Kuhlia mugil* fish in a quasi-2D 4-m wide tank, from isolated individuals to increasing group sizes (up to 30). We measure individual displacements every 1/12 s for 2 min.

For the isolated fish, we had to devise a new kind of spontaneous displacement model, namely the Persistent Turning Walker (PTW), which accounts for the time auto-correlation of its turning speed. Next, we used this spontaneous model as the null case against which we quantified the mutual influence of neighbours in groups. The law of interaction we found mixes positional and directional effects.

The emergent collective behaviour predicted by our biologically-grounded individual-based model was consistent with the observed one.

## **Three dimensional reconstruction of starling flocks: an empirical investigation of collective animal behaviour.**

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Bird flocking is a striking example of animal collective behaviour: thousands of birds gather above the roost, forming sharp-bordered flocks, which wheel and turn with remarkable coherence and synchronization. Despite an increasing theoretical interest, empirical investigations of collective motion have been limited so far by the difficulties of getting data on large systems. By means of stereoscopic photography and using statistical mechanics, optimization theory and computer vision techniques, we have measured for the first time the three-dimensional positions of individual birds in groups of up to three thousands elements. This allowed us to analyze global morphological properties of the flocks (shape, orientation, turning dynamics), as well as structural properties (neighbours distribution, density profile, hard-core repulsion). Most notably, we investigated the nature of the inter-individual interaction. We found that the interaction between birds does not depend on their mutual metric distance, as most current models and theories assume, but rather on the topological distance (number of intermediate neighbours). In fact, we discovered that each bird interacts on average with a fixed number of neighbours (six-seven), rather than with all neighbours within a fixed metric distance. We argue that a topological interaction of this kind is indispensable to maintain flock's cohesion against the large density changes caused by external perturbations, typically predation.

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*Notes*

**Referential acquisition of human labels in African grey parrots  
(*Psittacus erithacus*): efficiency of a new learning method**

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After years of debate, it is now well accepted that language could have evolved by natural selection. One of the main features of human language is referential communication which corresponds to the ability to communicate about events or objects in the environment. Several research teams investigate the ability of animals to use a communication system other than that specific to their species. For example, some apes were trained to referentially use the American Sign Language and lexigrams. Several bird species are capable of vocal imitation. Some parrots are able to referentially imitate human labels. In this study, we investigate the ability of two African grey parrots (*Psittacus erithacus*) to referentially learn French labels. We tested three different methods of learning: Model/Rival, developed by Pepperberg (1999), in which two humans interact in front of the subject; Imitation/Association which implies a repetition of a label and then the association between the label and the object; and Intuitive in which the experimenter handles an object and repeats its name in front of the subject. One bird learned several labels with the Imitation/Association method and none with the other methods. The other bird did not learn any label. These results contrast with previous experiments. Thus, this study demonstrates the efficiency of a new method to teach heterospecific referential communication to African grey parrots.

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**Polygyny is costly for females  
of the monogamous mound-building mouse**

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In mammal females, pregnancy and lactation are energetically demanding, especially when post-partum reproduction is the rule. To deal with this concurrent demand of energy, females may delay embryonic implantation for a few days that will lengthen the inter-delivery duration. Females have also developed strategies to ensure the help of conspecifics for achieving successful reproduction. In the monogamous mound building mouse *Mus spicilegus*, we have shown that paternal care reduced inter-delivery latency. Male is then to be considered as a valuable resource for the female. Nevertheless facultative polygyny has been observed in the field at the beginning of the reproductive season (April) when the sex-ratio was of 1 male to 3 females. In order to evaluate the cost of polygyny for females, we compared, under laboratory conditions, the time-budget and the reproductive success of females in monogamous and polygynous reproductive units. Polygyny had a strong negative effect on the reproductive success of females. Moreover, the presence of a second female in the reproductive unit did not allow mother to spend more time to feed. On the opposite, mothers spent more time inside the nest with pups in polygynous than in monogamous units. We then concluded that facultative polygyny observed in the field was mainly due to a shortage of males.

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## Effects of experimentally increased stress hormones levels on breeding success and survival in a long-lived bird: the Black-legged Kittiwake

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The life-history theory predicts the existence of a trade-off between the current reproductive episode and survival (i.e. future reproduction) but the mechanisms underlying this trade-off are poorly understood. Often considered as the 'stress hormone', corticosterone is thought to allow energy storing and adjust reproductive behaviour and physiology appropriately to the conditions encountered. Plasma levels of corticosterone rapidly rise in response to stressful conditions, which shifts energy investment away from reproduction. However, bearing elevated corticosterone levels over a prolonged period of time may compromise survival by decreasing immunocompetence and increasing lipolyse and proteolyse. In the present study, we investigate the relationship between annual survival probability and corticosterone levels in kittiwake *Rissa tridactyla* in High Arctic (Svalbard - Spitsbergen). We experimentally increase corticosterone levels of chick-rearing males in 2005 by subcutaneous implantation and monitor current reproductive success and return rate in 2006 and 2007. Long term survival was estimated by using MARK software. Corticosterone-implanted birds had a lower reproductive success in 2005 and an higher mortality rate next year. These results suggest that in Black-legged kittiwakes, bearing elevated corticosterone levels over a prolonged period of time during an energy demanding period is costly for the both life history traits (reproduction and survival).

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## **Parasitoid Wasp Contests**

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I review recent work on contest behaviour between parasitoid wasps, focussing mainly on female-female contests for possession of a host. Recent studies have examined the importance of a range of influences on contest outcome both together and separately: resource correlated and resource uncorrelated Resource Holding Potential and many components of Resource Value Asymmetries. It has also been shown theoretically and empirically that size-dependent contest outcomes influence clutch size decisions in a game theoretic manner. Recent work detecting and tracking chemical emissions has also revealed a volatile chemical component to parasitoids contests. In bethylid wasps, volatiles are released during more aggressive contests, and always by the loser of a bout of agonistic behaviour. The chemical may function as a weapon of rearguard action.

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**Long term effects of a juvenile behavioural syndrome  
in the highly social cichlid *Neolamprologus pulcher***

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Differences in life histories can generate individual differences in behavioural type. Only a few studies have investigated behavioural syndromes in cooperative breeders. In an earlier study we demonstrated a sex and age dependent juvenile behavioural syndrome in the highly social cichlid *Neolamprologus pulcher*. Here we present data of the same individuals, showing that aggression spills over into the adult breeder context. Males that had been aggressive as juveniles are more likely to keep subordinates in the group, while females aggressive as juveniles were more likely to expel them. Additionally, females produced smaller clutches when paired to a male that had been helpful as a juvenile subordinate in comparison to when paired to a male that had been more selfish as a juvenile. We think that female mate choice may drive the decision to help or disperse in males as predicted by kin selection theory: males with bad breeding prospects stay with their parents and delay own reproduction, deriving mainly inclusive fitness benefits, while males with good breeding prospects are selfish, grow fast and start reproducing on their own earlier. Our results highlights the necessity to study life histories over a long time period to understand variation in behaviour and particularly the evolution of cooperative behaviour.

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## Personalities in a cooperative breeding context

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In cooperative breeding societies individuals assist other individuals in raising their offspring. Understanding variation in life-history and behavioural decisions underlying the propensity to cooperate are a main focus of research. Variation in behavioural types might be the mediating factor in shaping these decisions. We illustrate this with research done in cooperatively breeding cichlid fish from Lake Tanganyika. These cichlids show high variability in the propensity to cooperate and disperse. Three topics are discussed during this workshop: (1) development of standardised testing procedures in cooperation research. (2) Behavioural flexibility within personalities and ontogenetic effects: fixed, switch points or a combination of both? (3) Hypothetical life-history trade-offs in co-operative breeders: whether and how they may be mediated by variation in behavioural traits.

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## The evolution of lethal fighting in the ant genus *Cardiocondyla*

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The ant genus *Cardiocondyla* is characterized by a peculiar male polymorphism with winged disperser males and wingless, so called “ergatoid” males. Whereas wingless males are docile and do not engage in aggressive competition for access to female sexuals, ergatoid males engage in deadly fighting with their ergatoid rivals. Depending on the species they either crush or pierce the still soft cuticula of freshly eclosing males with strong, shear-shaped mandibles, or they grasp their adult opponents with sabre-shaped mandibles and besmear them with hindgut secretions, which elicit aggression by workers.

A phylogenetic study based on mtDNA sequences suggests that fighting against adult rivals is the original status, from which fighting against callows evolved. Fighting among males has been lost secondarily in some species.

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## Female dominance over males In Primates: Self-organisation and sexual dimorphism

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The processes that underlie the formation of dominance hierarchies and inter-sexual dominance relations in primates have since long been under debate. Whereas models of self-organisation suggest that dominance hierarchies develop by the self-reinforcing effects of winning and losing fights (the so-called winner-loser effect), a different theory is upheld by the so-called ‘prior attribute hypothesis’, which assumed that they develop from pre-existing individual differences. We intend to investigate the relevance of these two theories for the dominance relations between the sexes in groups of primates. In groups of 22 species originating throughout the primate order, we quantify the degree of female dominance over males on a scale from 0 (no female dominance) to 1 (complete female dominance). Using the method of independent contrasts we find, against our expectation, that there is no association between female dominance over males and pre-existing sex differences in body mass. In contrast with this, the prediction derived from our model of self-organised dominance hierarchies which says that female dominance over males increases with the percentage of males in the group is firmly supported by our empirical data. This suggests that inter-sexual dominance relations are influenced by the winner-loser effect and by group composition. Since the winner-loser effect has been shown to work in many taxa including humans, these results have broad implications.

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## **The role of auditory contact and pair bond on preferences for mate's distance calls in female zebra finches**

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Zebra finches (*Taeniopygia guttata*) are capable of mate recognition, an adaptation well suited for a colonial species that forms long term pair bonds. Females are able to recognize their mate using acoustic information present in both song and distance calls. Previous research suggests that acoustic communication plays a role in maintaining the pair bond between mated pairs. While song, a sexually selected trait, has been shown to be behaviourally reinforcing to females, this has not been tested with other vocalizations that also serve critical biological functions. For example, the distance call, serves to maintain contact between individuals. Here we demonstrate, using an automated choice apparatus where females can GO to hear calls, that hearing a mate's distance call is more rewarding than the call of another familiar individual with whom no pair bond is shared. Subsequently we manipulated the pair bond, by re-pairing females with a new male, maintaining the original pair, or by simply separating the paired male and female, and then retesting birds GO response levels to the mate versus another male's call. We examine the changes in females GO responses to mates call after manipulating the pair bond, and consider these findings in light of the suggested role of vocal signals in maintaining pair bonds in this monogamous species that forms long term pair bonds.

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## Massive flocks under attack: modeling aerial displays of starlings

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The evasion patterns shown by huge flocks of starlings (*Sturnus vulgaris*) are remarkable examples of complex collective movement. Under attack of a predator (falcon) the flocks fragment and coalesce in densely compacted concentrations expanding and imploding on themselves – rapidly and highly synchronized. To get an insight in the underlying mechanisms, we extended our former model of flocks of starlings with a predator. Due to modifications of common rules of swarming (attraction, alignment and repulsion on local scale) and the inclusion of a flight model for the individual birds, the model already reflected unpredated flocks of starlings realistically. However, we couldn't replicate the exaggerated dynamic of the observed evasion patterns of flocks under attack. Here we study the effects of predators that attack at different locations of a flock, at different relative speed to the prey and in different contexts (while the flock is moving straightforward or turning, when it is compact and sparse). Further, we study the influence of reaction time on the emerging patterns. Our model show remarkable similarity to the behavior of real flocks in video coverage. This brings insight in the origination of the various reaction patterns of the flocks towards the predator and results in testable hypotheses for these patterns.

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## Do chicks present adaptive responses according to predation risk? A hormonal perspective.

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Recently it has been shown that chicks of altricial birds may perceive predation risk by acoustic cues produced by predators. This capacity involves changes to a less conspicuous behaviour in order to avoid being detected and predated. However, nothing is known about the physiological mechanisms underlying this capacity. Potential mechanisms may involve corticosterone, a hormone related to stress and testosterone, a hormone related to begging, an acoustic signal that may be used by predators. If chicks are aware of this risk they should develop: (1) a higher level of corticosterone and (2) lower level of testosterone. We manipulated perceived risk of nest predation in European blackbird (*Turdus merula*) using magpie (*Pica pica*) playback calls in the vicinity of nest sites and analysed plasma levels of these hormones in nestlings. Our results show a physiological pattern completely different to the one predicted: Chicks under high predation risk showed lower corticosterone and higher testosterone levels than those under low predation risk. We explain these results as an indirect response to the presence of a potential predator mediated by a reduction of parental visits. Corticosterone levels may then be adaptively decreased to cope with reduced food intake induced by a reduction of parental visits. Chicks may also increase their testosterone levels to beg more aggressively when their parents arrive at the nest.

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## Why do cryptic animals keep still?

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Animals that rely on crypsis to avoid detection by predators or prey often keep still. Although this suggests crypsis is ineffective when individuals are moving, this has never been tested experimentally. We used three-spined sticklebacks predating chironomid larvae to test whether movement has a greater effect on the detection of cryptic prey compared to when prey are conspicuous. Both increased movement (live versus killed in alcohol) and conspicuousness (white versus red background) significantly decreased the time taken for the fish to encounter the prey, although there was no significant interaction between the two factors. However, there was a significant interaction between movement and crypsis in the frequency of attacks once an encounter had taken place. The fish rarely attacked still prey on a cryptic background (1 of 18 encounters), compared to cryptic, moving prey (14 of 18 encounters) or conspicuous prey that was still (15 of 18) or moving (16 of 18). A second experiment examined which individual was targeted from a conspicuous versus a cryptic prey group. When the prey were cryptic, the fish targeted individuals which showed the greatest movement compared to the rest of the group. In marked contrast, on a conspicuous background, target selection was not significantly different from random targeting in terms of prey movement. To avoid detection, therefore, crypsis relies on minimising movement as well as matching with the background environment.

## How do odours of predators affect small rodent prey?

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In a carnivore / small rodent system, predator odour may act as a cue in prey's perception of predation risk. This may alter prey behaviour, including reproduction. Inhibition of reproduction was reported in several arvicoline species exposed to odours of specialist predators.

The advantage of inhibited breeding is explained by the Breeding Suppression Hypothesis. BSH assumes that non-breeding females benefit from reduced predation risk. This was first reported in a series of laboratory experiments, carried out under artificial conditions. Recently it was confirmed by a field experiment for the first time. However, migration and predation may affect the results of a field study; hence, BSH needs to be tested under semi-natural, controlled conditions.

In the work presented here we investigate the effects of high predation risk on several parameters of a vole population, including demography, reproductive output and dispersal. Six populations of common voles (*Microtus arvalis*) are separately enclosed in 0,25 ha plots. Migration is impossible, and ground predators have no access to the study area. In 3 plots, predation risk is simulated with natural odours of a mustelid. Control odours are applied in the other three plots. All odours are repeatedly released by spraying. Populations of marked individuals are monitored by live trapping throughout the whole reproductive season. In a single season, detailed data on reproductive activity of over 700 individuals is recorded.

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*Notes*

**From crypsis to aposematism:  
Experimental evidence for an adaptive ontogenetic colour change  
in the striated sheldbug *Graphosoma lineatum* (Heteroptera).**

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Protective coloration such as aposematism and crypsis occurs in many insects but only few species alter their defensive strategy during the same instar. We have hypothesized that one of them is the adult shield bug *Graphosoma lineatum* (GL) exhibiting an alternating black and non-melanized longitudinal striation. In Sweden, the non-melanized body parts of freshly moulted prehibernation GL are pale brown (presumably cryptic) but they change during hibernation to red (presumably aposematic). We have tested the adaptive functions of coloration of the two GL forms against bird predators. In one experiment with great tits, we measured detection time of the two forms against background of dry grass and plants, simulating late-summer conditions, and found that the birds took longer time to find the pale than the red form. Thus, the pale form of GL is more cryptic in a dry environment than the red form. In a second experiment, naïve domestic chicks we measured attack rate on red and pale adults and fifth-instar larvae (black and brown) to investigate avoidance and generalisation between the stages. Chicks initially found the red form most intimidating, but both adult forms are more intimidating than the larva. Moreover, there was a broad generalisation among forms. These experiments suggest that the pale brown adult invests in a cryptic strategy at the cost of reduced protection from aposematism, whereas the red adult benefits from aposematism at the cost of reduced camouflage.



## **Personality, variation and fitness: a fishy perspective**

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Researchers studying animals are often intrigued by their high levels of inter-individual behavioural variation. Our task is to explain how this variation is generated and maintained in animal populations. Recently, the concept of animal personality (or behavioural syndromes) has become a popular tool for explaining consistency in inter-individual behaviour. However, attempts to find general correlations between personality traits and fitness have often been unsuccessful, suggesting that fluctuating selection pressures in complex and unpredictable environments tend to disrupt any fixed association between behaviour and fitness, thereby maintaining individual variation. In addition, there are inherent problems associated with extrapolating laboratory measures of behaviour to natural conditions. How do we know that we measure anything relevant? Finally, if behavioural variation is caused by state-dependent tactics reflecting social or energetic status should it really be defined as personality variation? I will use some of our work on salmonid fish as well as other recent studies to discuss these and related issues.

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*Notes*

**What is ‘interesting’ about personality?  
Some less-explored themes and their implications**

**Kazem Anahita**

Abstract not received

**Group decision-making in fission-fusion societies:  
implications from field experiments in Bechstein's bat colonies**

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How animals make group decisions has important implications for our understanding of animal societies. The available models conclude that shared (“democratic”) decisions outperform unshared (“despotic”) decisions, even in situations where individuals disagree about actions. This is surprising as in most other contexts, differences in individual preferences lead to sex-, age-, or kin-specific behaviour. Empirical studies testing the predictions of the theoretical models are only beginning to emerge. Since Bechstein's bat colonies are fission-fusion societies that depend on daily group decisions to select their communal roosts Bechstein's bats provide unusual opportunities for this kind of research in wild animals. I used field experiments that allowed for the manipulation of the individual behaviour of group members to study group decisions in situations where individuals differ in their interests. To create conflicting interests I manipulated the information of individuals belonging to two different Bechstein's bat colonies and then measured the outcome of the resulting group decisions. Conflicting information among colony members did affect the outcome of group decisions and the use of communal roosts suggested that group decisions in Bechstein's bats are shared among the group members. Moreover, I will provide evidence that group decision-making in fission-fusion societies of Bechstein's bats is not based on independent individual decisions.

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*Notes*

## Interspecific interaction amongst four sympatric carnivore species in the Free State, South Africa

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Livestock depredation has caused serious human-carnivore conflicts linked to the implementation of lethal control techniques. To determine the collective effect and possible interspecific competition, the stomach contents of four sympatric carnivore species collected over a period of eight years in the Free State, South Africa, were examined. The aardwolf (*Proteles cristatus*) and bat-eared fox (*Otocyon megalotis*) are predominantly insectivorous, feeding mainly on termites, are not responsible for domestic stock losses and should therefore not be victimised. Owing to the strong bias towards material obtained from problem areas via control programmes, small stock constituted a significant portion of the stomach contents of the black-backed jackal (*Canis mesomelas*) and caracal (*Caracal caracal*). Black-backed jackals are intensely persecuted by farmers and population control efforts appear largely ineffective and probably only succeed in producing a temporary reduction in local numbers. However, eradication of black-backed jackals in an area is speculatively associated with increases in abundance and range expansion of caracals, implying release from competitive pressure. Caracals occupy a larger home range and the severity of depredation is more damaging compared to the black-backed jackal. The vast majority of individual carnivores, however, perform a vital function in the ecosystem.

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## **Aggressiveness in a variable environment: Ural owl and nest defence**

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According to animal personality studies behavioural syndromes and the lack of individual plasticity in temperament traits, such as aggressiveness, affect individual fitness. We studied aggressiveness in Ural owl nest defence behaviour during the nestling period from 1986 to 2006. Ural owls defend their nests fiercely by attacking and hitting intruders with their talons. Because of the risk of injury or death of the owl this is a costly behaviour (pers. obs.). Due to the nature of microtine vole dynamics Ural owl clutch size is phenotypically plastic (1 – 7 eggs). Vole densities in our study area vary more than 100-fold between seasons and strongly affect overwinter survival of young and adults, recruitment and reproductive success of Ural owls. Aggressiveness was analysed on individual level using linear mixed model approach. Aggressiveness varied between individuals. Aggressiveness was positively affected by spring vole densities (an indicator of offspring recruitment possibilities), overwinter change in vole densities, and brood size, but negatively by laying date (a proxy for offspring fitness). Females did not adjust their behaviour according to the per capita food intake of nestlings. Aggressiveness was not heritable. Thus females adjust their behaviour according to environmental cues (vole dynamics) and their individual reproductive effort (laying date and brood size).

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## Towards the nature of the relationship between humans and their companion animals

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Due to the evolutionary continuum and convergent selection, humans share a number of basic social and cognitive tools with other vertebrates, i.e. brain and physiological mechanisms. Hence, a Darwinian framework is appropriate for investigating human-animal dyadic relations. With our studies (behaviour coding, experimental and questionnaire) in 40 human-cat dyads and in 22 human-dog dyads (intact male dogs with their female and male owners), we aimed at elucidating some of the basic and central principles of human-companion animal dyadic relationships, notably the influence of dyadic sex, owner attitude and personality on the behavioural expression of the animal partner and the interaction structure and symmetry of the dyad. We indeed, found contingencies of these factors with the behavioural expression and social roles assumed by the animal companion and the temporal patterning of dyadic interactions (revealed by THEME software). Partners in human-animal dyads mutually adjust to each other, satisfy each others social needs, but, as in any within-species dyadic bond, asymmetries and conflicts are also inherent to human-animal dyads. We conclude that a number of features makes human-animal dyads better accessible to research than intraspecific dyads (animal-animal or human-human), rendering them a valuable model system for investigating basic principles of higher vertebrate dyadic organization, including human-human. Funding by MARS and IEMT Austria.

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## The role of canine genetic traits behind dog-human relationship: A starter

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Although the study of various neurotransmitter-associated gene polymorphisms and personality trait associations has a long history in humans, similar approaches have been applied to animals only recently. However, there are many methodological issues that have to be solved before such an approach in animals could yield robust results. For example, presently there is no consensus on validated traits, especially if one decides to use direct behavioural observations instead of questionnaires. Similarly, little is known about the differentiations between personality and temperament. Undoubtedly though, consistent individual differences do need to be considered when choosing a pet, thus avoiding unsuccessful adoptions. Behavioural causes such as hyperactivity, fearfulness, noisiness are prevalent reasons for companion animal relinquishment. In the present talk we will emphasize some of the major methodological problems in animal personality research and present our recent findings on how candidate genes from the dopamine neurotransmitter system might affect the behaviour of dogs toward an unfamiliar human. We have found significant associations between the dopamine D4 receptor and the behaviour towards the female experimenter during DNA collecting and greeting. Finally, we will point to the limits of the results and draw some suggestions on how to improve the study of the animal personality.

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## **Host qualities discrimination by solitary parasitoid females: impact on oviposition strategies and fitness**

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Parasitoid females lay their eggs on host organisms. In solitary species, only one adult can emerge from a host whatever the number of eggs initially laid, because of lethal larval combats. Thus, unparasitized hosts are more profitable for parasitoid females than already parasitized one. Moreover, the survival rate of eggs laid on already parasitized hosts could also vary from one host to another, depending on the development stage and the sex of first eggs. Thus, females should adapt their oviposition strategies according to these factors and need to assess such information.

In this study, we show that females of the solitary parasitoid *Anisopteromalus calandrae* can discriminate different categories of hosts: unparasitized and parasitized hosts, and hosts parasitized by an egg just being laid or by an egg being about to hatch. Moreover, they adjust their offspring sex ratio according to the sex of eggs already laid and about to hatch, laying more males when female eggs are already present in the vicinity. Nevertheless, they do not lay male eggs on hosts already parasitized by a female egg, thus avoiding a mortal combat between their sons and females they could mate after emergence, and thereby increasing their sons’ mating success and at the same time their own fitness.



**Role of familiarity in the formation of shoals in juvenile fishes:  
a comparison of two sympatric species**

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The composition of fish shoals in nature is based on non-random associations between individuals. Fishes are known to shoal preferentially with individuals of similar body length, with conspecifics, and sometimes with socially familiar individuals. The role of familiarity (a preferred social association with individuals with whom one has previously interacted) in fish behavioural ecology has recently received considerable attention. However, evidence for this social preference phenomenon remains somewhat ambiguous and controversial. Using a laboratory binomial shoal-choice test, we compared the role of familiarity in shoal-choice decisions in two sympatric species of fishes, juvenile banded killifish (*Fundulus diaphanus*) and juvenile bluegill sunfish (*Lepomis macrochirus*). Our study subjects were collected from the shallow, littoral zone of a lake. Groups of socially familiar and unfamiliar conspecifics were created in the laboratory. Killifish demonstrated a strong preference for familiar shoal-mates, whereas sunfish exhibited no preference for either familiar or unfamiliar shoal mates. Bluegill sunfish are known to possess the ability to recognise individuals; therefore, the lack of familiar shoal mate preference here is likely an active choice. The different role of familiarity in shoal mate choice between killifish and sunfish could be due to their different ecologies and life history strategies.

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**Is the comparative study of 'cognitive complexity' at the level  
of the whole brain a waste of time?**

**Lefebvre Louis**

Abstract not received

**Social informers and thieves: are heterospecifics different from conspecifics?****Lefebvre Louis,**

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The founding paper on social learning in birds, the opening of milk bottles by tits in England, has started a tradition dominated by research on transmission mechanisms of feeding techniques between conspecifics. Recent research has attempted to balance this tradition with a focus on innovation, on behaviours other than feeding and on transmission between species. Ecological contexts seem to determine whether conspecifics or heterospecifics are more effective social informers. The eventual benefits of social information can be compensated by the costs of scrounging and theft. Examples on social learning and theft will be given from field work on Carib grackles and Zenaida doves. The producer-scrounger game and the prediction that intra- and interspecific kleptoparasitism are one and the same (two major contributions made by Chris Barnard) will be used to analyse dunking and theft.

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## Public pigeon houses : redomesticating feral pigeons?

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Feral pigeons (*Columba livia*) are among the most abundant birds in European cities. Their successful establishment in towns contrasts with their controversial relationship with city dwellers ; some dislike or fear them as a source of pollution or because of their behaviour, whereas others protect or feed them. Urban pigeons, viewed as too numerous since the 50's, have been subject to many control policies in European countries. First based on methods such as euthanasia, they have neither achieved their goal nor have they been accepted by urban citizens. A new method emerged in the 80's in Switzerland, based on public pigeon houses. First devoted to reduce the number of pigeons (by allowing reproduction control), the pigeon houses installed in Paris and its region also aim at relocating pigeons to acceptable places (urban parks).

As a part of a general research program on “urban pigeons”, we headed on an ethno-ecological study in Fontenay-sous-Bois (94, France), to know whether pigeon houses enable to end the social conflict between urban citizens and pigeons.

-Do public pigeon houses change the behaviour of pigeons toward humans?

-Do they make pigeons more acceptable in cities, by giving them an aesthetical function in urban parks?

-Do they participate in a new form of domestication of this feral species?

It appears that the results are strongly dependent on the geographical and socio-cultural context and that a management of pigeon populations at a city scale is needed.

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## Evolution of brain size in mammals: A role for sperm competition?

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The evolution of brain size has generated long-standing debate in evolutionary ecology research. Recent studies have focused attention on the potential influence of sperm competition in the evolution of mammalian brain size. It has been suggested that investment in testicular tissue under sperm competition is traded-off against investment in a metabolically expensive organ, the brain (the expensive sexual tissue hypothesis). In support of this idea, it has been previously reported that promiscuous bat species have evolved relatively large testes but small brains. Here, we employ phylogenetically-controlled methods to test for evidence of a correlation between brain size and sperm competition level across a wider range of mammalian groups, and extend previous analyses to look for evidence of potential trade-offs between testes size and the volume of specific parts of the brain that may be involved in precopulatory sexual selection (e.g. accessory olfactory bulb, amygdala). We also consider the potential role of ecological factors in explaining relationships between brain size and sperm competition level within various mammalian orders. Our results demonstrate that an evolutionary trade-off between brain (or specific parts of the brain) and testes mass is not a widespread phenomenon in mammals, and emphasise the importance of ecological variables in explaining interspecific differences in brain size across species.

## Foraging under uniform risk from different types of predators

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All animals invest time and energy searching and handling food and are rewarded in terms of energy. Some must actively search for food that is patchily distributed. The value of a spotted food resource depends on the level of perceived risk while foraging or travelling.

Economic decisions are made by maximising gain while minimising risks by avoiding high risk places or time-frames. But if in an environment all places and times are of equal risk, patterns of local investment at food patches should change. To provide experimental support for this prediction, we exposed bank voles (*Myodes glareolus*) to artificial resource landscapes that were equal safe or unsafe and, in a second experiment, added different predator types to test for predator specific answers in foraging patterns. Avian risk was simulated by different levels of cover, mammalian risk by odour samples of the least weasel. Results show, that animals concentrated their effort on a lower number of food patches, accepting a lower return instead of sampling all possible sources in high risk situations. Additionally, foraging patterns were predator specific for avian and mammalian predators as well on a spatial as on a temporal scale. While scent marks evoked strategic changes in a very short time frame, missing cover changed the feeding behaviour permanently. This shows that voles perceive the level and type of risk and do react with adaptive strategies.

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### **Hairiness and warning colours as components of antipredator defence: additive or interactive benefits?**

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To deter predator attack, aposematic prey species advertise their unprofitability with one or more conspicuous warning signals that, in turn, enhance the avoidance learning of predators. We studied the costs and benefits of multicomponent signalling in *Parasemia plantaginis* moths. The hairy moth larvae have an orange patch on their otherwise black bodies. The patch varies phenotypically and genetically in size. We studied the signal value of different defence traits within a multicomponent signal by testing which combination of two traits, hairiness and the presence or size of the orange patch, most affected the avoidance learning rate of predators. The orange patch had a higher signal value for the predators than did hairiness, which only slightly increased the survival of totally black or small patched larvae but did not affect the defence of larvae with a large orange patch. Moreover, the avoidance learning rate were quicker when larvae had large orange signal size. Multicomponent defences are therefore not necessarily additive and variation in the warning coloration of aposematic animals may be partly explained by variation in the relative benefits of different components of a warning signal to different predators.

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## Signal design and evolution of aposematic signals

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Aposematism is a strategy where conspicuous prey advertise its defence level to predators with conspicuous colours or patterns. Certain colours and colour patterns are suggested to communicate the defence levels better to predators than others. We specifically tested whether different patterns that are initially preferred are better associated with defence than those that are non-preferred. We first designed 4 symbols that were equally visible but had different designs (sail, stamp, diamond and square). When all prey types were presented together great tits (*Parus major*) preferred squares and avoided sails, but when these two symbols were presented together the preference was non-significant. We then carried an experiment in the “novel world”, where we compared the avoidance learning rates between the preferred (square) and non-preferred (sail) defended prey against a cryptic undefended prey. Birds learned to avoid the preferred prey quicker than the non-preferred, which is not in line with many previous findings. Potential implications of the results to the signal design will be discussed.

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## **Hatching asynchrony, parental provisioning and nestling begging within zebra finch broods**

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Inter-generational conflicts of interest arise over the level of parental investment provided and the within-brood distribution of that investment. Parents attempt to exert control by determining brood sizes and hatching patterns, whilst offspring growth rates and begging activities are retaliatory mechanisms that potentially enable the offspring to manipulate parental provisioning behaviour. Therefore, by simultaneously controlling zebra finch brood sizes and experimentally manipulating hatching patterns, we examine the extent to which parents exert control over within-brood resource allocation and the begging behaviour of asynchronously hatched nestlings. Within asynchronous broods, the probability of individual nestlings being fed increased with nestling age and the begging intensity of nestlings. Within synchronous broods, the probability of being fed was also higher for chicks that begged harder but additionally, mothers were more likely to feed sons over daughters, while fathers showed no such bias. Avian parents may preferentially provision offspring if nestlings differ in their energy requirements and / or if there is local resource competition or enhancement. However, this study provides no evidence in support of these ideas or that of sex-specific begging behaviour.

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## Sex difference in the use of environmental cues for the learning of food preferences

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The cognitive processes of predators play a central role in the evolution of prey characters. Numerous studies have shown that predators may learn to associate characteristics of prey (e.g. colour) with the cost or benefit of ingesting them, thus forming preferences and aversions for different kinds of prey. Although the quality of prey may differ between environments, it has not been investigated whether environmental cues are used in the formation of food preferences in vertebrates. Here we show that wild-caught great tits (*Parus major*) form a strong association between prey quality and environmental cues, and that females rely more on such cues than do males. The same individuals were able to learn and maintain different sets of food preferences and aversions for use in different environmental contexts, suggesting a central role for contextual learning in vertebrate predator psychology. The stronger adherence of females to environmental cues indicates a sex difference in cognition and/or feeding strategies. We suggest that females may rely more on well-tested feeding rules than do males because females can transfer ingested toxins to their offspring, making feeding mistakes more costly for females than males.

## We all appreciate and thus support the same species

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Animals have been an integral component of human environment since the very beginning of our species and it can be assumed that our mind should be prepared to respond to animal stimuli. Thus we ask about the existence of cross-cultural congruence in aesthetic perception of animal species. To find the answer we enquired young people from Bolivia, Czech Republic, Morocco, Papua New Guinea and Philippines. All respondents were asked to rank the same 32 photographs of the python and boa species according to perceived beauty of the depicted snake. Mean ranks of the species obtained in different parts of the world tightly correlated, e.g. the correlation between mean ranks provided by European and Papuan respondents explained 76% of variation ( $p < 0.0001$ ). We can conclude that aesthetic preferences towards animal species may be more universal than expected.

We can see a potential risk in widely shared human aesthetic preferences of animal species and in next study we focused on the effect of species attractiveness on ex-situ conservation efforts (650 zoos and aquaria). Respondents evaluated pictures of 56 boa and python species according to perceived beauty. Surprisingly, the size of zoo population is best explained by species attractiveness and its average body size. Contrariwise, variables associated with species rarity had no effect. This fact should raise alarm as inconspicuous endangered species may be overlooked in conservation policy.

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## Coloniality and social foraging in wild Zebra finch

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Coloniality is a puzzling habitat use strategy because it challenges the idea that fitness decreases with increasing density. If living at high density is costly, we then expect coloniality to bring some benefits. Here we used an experimental approach to investigate the foraging costs and benefits of coloniality in wild zebra finch in its native habitat. We manipulated nest site and food location and brood size to compare the foraging strategies of colonial and solitary pairs as well as non-breeding adults. We provided birds with ad-libitum seeds in 5 feeders scattered in the study area, and change their location every 7 days. In total, 150 adults were fitted with a transponder tag and their visits to the active feeders and to their nest were automatically recorded throughout the chick-rearing period. We could then determine whether birds foraged optimally, how fast each individual found a food patch, and chick-provisioning rate. Individuals did not follow the Ideal Free Distribution: some feeders were disproportionately popular and birds did not forage in the closest feeder to their nest. Moreover, for each feeder, we identify channels of information transfer among breeding birds by mapping the nest location of the birds that successively found the feeder. Lastly, colonial and solitary pairs had similar chick feeding rate. Our results raise interesting questions about the influence of social factors on foraging strategy and partly explain its departure from optimality.

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## Developments in dietary conservatism

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This talk will introduce the audience to some interesting developments in our understanding for the way in which animals expand their diet. The discovery of a strong and long lasting aversion to novelty, present in populations of birds was named dietary conservatism. Intriguingly there is a population level balance in two foraging strategies, between individuals showing dietary conservatism, and “adventurous eaters” who only show a very transient aversion to novelty known as neophobia. This balance has been reasonably constant in every population yet tested. We have demonstrated that dietary conservatism is present in both fish and birds of a number of species, and in very differing habitats. We have also demonstrated its absence in two species of invertebrate, suggesting that while the trait is widespread or universally found in vertebrate visual foragers, it may be absent in invertebrate predators. However further study of this is underway, the results of which will be presented in this talk. Discussion of these results, and some interesting evidence gathered during the predator observations indicating a severe departure from optimal foraging assumptions will conclude the talk.

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### Owner vs Stranger influence on the dogs' performance in two food discrimination tasks.

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In a quantity discrimination task between a large and small food quantity, dogs independently choose the larger food quantity but after observing their owner expressing a preference for the small one they conform to the owner's choice (Prato Previde et al 2008). In the following studies we investigated whether the owner and a stranger may differentially influence the dogs' choices. In Study 1, a version of Prato-Previde et al's (2008) experimental paradigm was administered to 15 dogs with their owner and 15 with a stranger. Results confirm previous findings but no difference emerged between the owner and the stranger's influence on the dogs' performance. In Study 2, the difference in resource value was increased further. In Condition 1 dogs chose independently between a slice of sausage and a food pellet. In Condition 2 the same choice was available but with owner or stranger showing a preference for the food pellet. In Condition 3 dogs chose between a single food pellet and 8 slices of sausage, with owner or stranger showing a preference for the food pellet. Results showed dogs choosing the food pellet significantly more in Condition 2 than in Condition 1 (thus conforming to the person's choice;  $z=3.17$ ,  $p=0.001$ ) and a significantly decreasing influence of the person from Condition 2 to Condition 3 (as the value of the resource increases;  $z=2.5$ ;  $p=0.009$ ). No difference emerged between owner and stranger. Results are discussed with reference to the domestication process.

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## **The relative effect of testosterone and parasites on testosterone-mediated carotenoid-based ornaments: does social context mediate carotenoid allocation priorities?**

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There is growing interest on the mechanisms which constrain or enhance physiological availability of carotenoids and their allocation to ornaments or to enhance immune function. Testosterone and parasites are the two main factors affecting carotenoid availability. Testosterone may enhance ornament expression or may incur in a cost for the signaler by immunosuppression. Intestinal parasites may constraint carotenoid acquisition, affecting their deposition on ornamentation. However, the relative effect of these factors on sexual traits (size and colouration), remains unknown. In two experiments we explored the relative effect of testosterone and parasites on ornament (comb) size and colouration in wild red grouse. Firstly, manipulated testosterone and intestinal parasites in a factorial and replicated experiment. We found that testosterone increased comb size. However, testosterone increased comb colouration more than did parasites and differing between sites. Secondly, we explored the effect of three different levels of testosterone on grouse ornamentation in 5 populations differing in density. We found that lower levels of circulating testosterone were enough to maximize comb size, but its effect on comb colouration and circulating carotenoid was site-dependent. We suggest that comb size and comb colouration may convey different information about the bearer and that different social context might influence carotenoid allocation towards self-maintenance or ornament colouration.

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*Notes*

## The role of non-host predator avoidance in parasitic strategies

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Dealing with the anti-predatory adaptation of intermediate hosts is a strategy adopted by trophically-transmitted parasites to achieve their life-cycle. We tested the hypothesis that parasites could benefit of increasing the anti-predatory responses of their intermediate hosts to avoid non-host predators.

The freshwater amphipod *Gammarus roeseli* serves as an intermediate host for the bird acanthocephalan *Polymorphus minutus*. In addition to the reverse geotaxis induced by *P. minutus*, which is assumed to facilitate trophic transmission to the final host, we recently pointed out that infected *G. roeseli* has a better escape performance than uninfected specimens. This could be of selective importance if it reduces predation risk by non-hosts. Considering the perception of predator cues as an efficient anti-predatory adaptation, we investigated how infected amphipods react to fish cue.

*G. roeseli* spent more time both on refuges and at surface in scented water than in control, but this response was exacerbated in parasitized amphipods. Experiments demonstrated that this behaviour prevents infected gammarids from predation by sticklebacks (*Gasterosteus aculeatus*). In field, habitat overlap indices revealed that predation pressure from invertebrate predators occurs on uninfected preys rather than on infected ones, because of a spatial segregation induced by manipulation. Taken together, these results provide evidence for the role of non-host predator avoidance in parasitic strategies.



## The influence of visual background on prey detection and evolution

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Prey crypsis and detection have typically been thought to be influenced by prey colour pattern (e.g. pattern symmetry) as well as by the visual relationship between prey colour pattern and the background, against which the prey is seen (e.g. background matching). Here, I present theoretical and empirical results, suggesting that also the appearance of the background as such can influence how easily a prey will be detected. First, an evolutionary simulation model suggests that it is more difficult to produce a highly cryptic appearance in a visually simple than in a complex habitat. Second, a predation experiment with birds and artificial prey support the model by showing that increased variability in background pattern geometry make it more difficult for the birds to find the prey items. Third, another predation experiment shows that also an increased contrast range of visual elements in the background makes it more difficult for the birds to find the prey items. Together these results suggest that, although previously largely neglected, the visual appearance of the environment as such may have an important influence on prey evolution. I will discuss these evolutionary consequences with respect to optimal design of cryptic coloration and aposematic signals, prey behaviour and optimal choice of defence strategy.

### **Mate copying and stimulus generalization in an invertebrate: personal versus public information use**

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Female mate copying is a form of public information use that may reduce costs of mate choice and increase skews in male mating success. We tested with two complementary experiments whether female *Drosophila melanogaster* copy the mate choice of other females by manipulating public information. In a first experiment we show that when a female faces two similar males artificially colored differently, they preferably mate with the color-type of male she previously observed mating, indicating that *Drosophila* females are able to generalize a socially learnt information. In a second experiment involving a more natural setting using natural variation, we further demonstrated, by producing two contrasting male phenotypes (high- or low-condition males) that after being observed with an attractor female, male mating success increased for high-, but not low-condition males. The effect of social information was memorized for a relatively long period of time, i.e. twenty-four hours at least. This first study of mate copying in an invertebrate shows that public information use is taxonomically more widespread than previously known and provides new insight into the learning capacities of *Drosophila melanogaster*.

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*Notes*

## **Do ecological extremes hamper the evolution of coping styles?**

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Individual coping styles are widespread among animals including distant taxa as ants, squid, birds, and mammals. However, there is wide variation which behaviours are correlated with each other and in the direction of this relationship. Finally, there are differences in coping styles when comparing different populations of the same species.

Little is known about which ecological factors favour or hinder the evolution of coping styles, although predation pressure may be one of those factors. However, no general framework exists that can be used to predict and test the presence or absence of coping styles under different ecological regimes.

I use the two-factor model which has been developed to explain interspecific differences in neophilia (extraversion) and neophobia (neuroticism) as a framework to predict under which environmental constellations coping styles are likely to evolve. The main prediction is that when a behavioural trait is under very strong selection pressure (e.g. low aggression or high exploration etc.) that this trait is unlikely to be part of a coping style (i.e. correlated with another trait). Moderate selection pressure, in contrast, may favour the evolution of coping styles to allow adaptation to local conditions.

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## **Dogs Accurately Search for Invisibly Displaced Objects**

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Dogs were tested for object permanence using an invisible displacement in which an object was hidden in one of two containers at either end of a beam and the beam was rotated. Consistent with earlier research, when the beam was rotated 180° the dogs failed to find the object. However, when the dogs were led 180° around the apparatus they were successful. Furthermore, when the beam was rotated or the dogs were led only 90° they were also successful. In a control condition, when the dogs could not see the direction of the 90° rotation, they failed to find the object. Results suggest that the 180° rotation may produce an interfering context that can be reduced by rotating the apparatus only 90° or by changing the dogs' perspective. Once the conflict is eliminated, dogs show evidence of object permanence that includes the ability to represent invisibly displaced objects.

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**Risk-taking behavior in a marine fish (*Dicentrarchus labrax*):  
influence of selection for growth on responses**

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Finding criteria that could characterize coping abilities and stress tolerance become important to understand if selected fish present good adaptation to the rearing environment and high welfare potential. In this study, differences in risk-taking behavior are investigated in sea bass, between a Wild population issued from wild breeders and a Massal population issued from breeders selected for growth. Risk taking tests were carried out on 360 fish, and 3 tests (T1, T2 and T3) were realized at one month interval. Risk taking score was evaluated via a maze test between 'safe' and 'risk' zones by recording the number and the duration of individual passages through a divider. Results showed that, if Wild fish were in general more reactive than Massal fish during T1 and T2, they showed a decrease in risk taking score during T3; Wild bold fish were smaller than Massal bold fish and hunger seemed to be the highest motivation for risk-taking behavior. Finally, individual learning, memory and social learning abilities were demonstrated for sea bass. Fish selected for growth displayed a slower learning but remained consistent within time and were potentially less sensitive to different stressors and consequently better adapted to the rearing environment.

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## **Mechanisms for aggregation in animals: rule success depends on ecological variables**

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Under the threat of predation, animals often group tightly together, with all group members benefiting from a reduction in predation risk through various mechanisms, including dilution, encounter-dilution, and predator confusion effects. The selfish herd hypothesis proposes that in order to reduce its risk of predation, each individual should approach its nearest neighbour (NN), reducing its risk at the expense of those around it. Despite extensive empirical support, the selfish herd hypothesis has been criticized on theoretical grounds: approaching the NN does not result in the observed dense aggregations, and the NN in space is not necessarily the one that can be reached fastest. Increasingly complex movement rules have been proposed, successfully producing dense aggregations. However, no study has made a full comparison of the different movement rules within the same modelling environment. Further, ecologically relevant parameters, such as the size and density of a population or group and the time it takes a predator to attack, have thus far been ignored. Here, we investigate the reduction in risk for animals aggregating using different strategies and demonstrate the importance of ecological parameters on risk reduction in group-living animals. We find that complex rules are successful at reducing risk in small, compact populations, whereas simpler rules are successful in larger, low-density populations, and when predators attack quickly after being detected by their prey.

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## Why are small males aggressive?

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Aggression is ubiquitous in the animal kingdom, whenever the interests of individuals conflict. In contests between animals, the larger opponent is often victorious. However, counter intuitively, an individual that has little chance of winning (generally smaller individuals) sometimes initiates contests. A number of hypotheses have been put forward to explain this behaviour, including the ‘desperado effect’ according to which, the likely losers initiate aggression due to lack of alternative options. An alternative explanation suggested recently is that likely losers attack due to an error in perception: they mistakenly perceive their chances of winning as being greater than they are. We show that explaining the apparently maladaptive aggression initiated by the likely loser can be explained on purely economic grounds, without requiring either the desperado effect or perception errors. Using a game-theoretical model, we show that if smaller individuals can accurately assess their chance of winning, if this chance is less than, but close to, a half, and if resources are scarce (or the contested resource is of relatively low value), they are predicted to be as aggressive as their larger opponents. In addition, when resources are abundant, and small individuals have some chance of winning, they may be more aggressive than their larger opponents, as it may benefit larger individuals to avoid the costs of fighting and seek alternative uncontested resources.

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## Individual recognition and genetic bases of mating patterns in a monogamous seabird, the black-legged kittiwake (*Rissa tridactyla*)

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Most seabirds are genetically monogamous and faithful from one reproductive season to the next, despite numerous opportunities of extra-pair copulations since such species are often colonial. Such fidelity raises the questions of individual recognition and mate choice, that we tested in the black-legged kittiwake (*Rissa tridactyla*), a monogamous seabird with high inter-annual mate fidelity. On one hand, we show that mates recognize each other vocally, and that chicks also used the long-call of their parents to recognize them. Parental recognition of offspring at fledging is also supported by the fact that newly fledged chicks return faster to their nests if parents react to their calls. On the other hand, we show that kittiwakes appear to be mated with genetically more dissimilar individuals than expected by chance, a pattern that seems to allow them to produce better and more heterozygous offspring. Genetically dissimilar pairs have higher hatching success, and homozygous offspring grow slower and are more likely to die before 25 days old than heterozygous offspring. However, cues used by individuals to estimate their mate's genotype are still speculative. Vocal parameters are not likely to give information on genetic similarity, as calls of genetically dissimilar pairs do not differ from calls of genetically similar ones. Other parameters, whether visual or olfactory, may therefore be involved.

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### Notes



**Individual variation in parental behaviour predicts chick survival  
of Cape gannets (*Morus capensis*).**

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Seabird populations are declining worldwide, potentially caused by changes in food availability. Are all individuals affected in a similar way? We studied the relation between both annual and individual variation in parental provisioning behaviour and the breeding success of Cape gannets breeding at Ichaboe Island (Namibia) in two years with very different nesting success. In this long lived species we expected more pronounced individual differences in chick feeding than in parental condition. In the year with low nesting success parents visited the nest at a lower frequency and were in lower condition, consistent with the interpretation that the food situation was indeed poor. Within the poor year individual differences in provisioning but not of parental condition were associated with chick growth and survival. These individual differences remained when controlled for seasonal changes. Individual parents did thus differ in their breeding success in concert with their foraging behaviour but not with their condition consistent with our general expectation. These results suggest that a poor food situation may not only lower the average reproductive potential of the population but also favours particular parents. Knowledge of such potential selective agents may be crucial to understand how changes in food availability will affect population dynamics and population composition.

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### **To fight a brother: for what?**

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Eurasian lynx is one of few mammalian species where sibling aggression results in hard traumas and death of some kittens. This phenomenon occurs at the age 35-64 days in a half of the litters with 2-4 kittens. The aim of this study is to identify the reasons and the consequences of this phenomenon. We compared kittens' physical and behavioral development in 36 lynx litters (19 with and 17 without fights). Fights occurs significantly more often in litters with low growth rate (less than 20 g per day). They coincides with the decrease of growth rate during kittens ontogeny and diet changes. However physical development of aggressors did not differ from other kittens before the fights. Trigger mechanism of spontaneous attacks was not related to testosterone-level and was correlated with adrenal activity. Fights consequences depended on their results. Fights winners were able to increase their growth rate (despite to some injures) in opposite to losers. Winners as well as neutral kittens were able to improve their hierarchical position. The asymmetry in social relations became significantly more obvious after the fights. Winners got some advantages in feeding order as well and were able to defend their food successfully. In case of death of the sib winners increased they growth rate in 2,5 folds. Sibling aggression in lynx is an adaptive phenomenon that brings some advantages to the winners and may increase their survivorship.

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**Spatial variation in cheating behaviour of the cleaner wrasse**  
*Labroides bicolor*

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Individuals of the well-studied cleaner wrasse *Labroides dimidiatus* have small fixed cleaning stations which are visited repeatedly by the same ‘client’ fish. Although cleaners can cheat by feeding on healthy client tissue instead of parasites, the occurrence of repeated interactions makes long term cooperative investments more attractive relative to immediate benefits of cheating. In contrast, the closely related cleaner *Labroides bicolor* roves over large home ranges of up to 1200 m<sup>2</sup>. Roving is predicted to undermine cooperative behaviour as partners are not readily available for repeated interactions. So how do large home ranges affect the service quality that *L. bicolor* offers to clients? In a field study on Moorea, I found that these cleaners do not use their home ranges in a uniform way: individuals spend most of their time in core areas of the home range and the peripheral area is visited only occasionally. I recorded the GPS location and outcome of individual interactions between cleaners and clients within the home range. I found that interactions in the core areas lasted longer and were more cooperative than interactions in the periphery, which were shorter and had higher cheating frequencies. This suggests a location dependent variation in behaviour of *L. bicolor*. Cleaners seem to mainly exploit clients with which they are unlikely to interact in the foreseeable future but are more cooperative with regular clients located in the core area.

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## Personalities in fish without genetic differences: a model

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Differences in personality between individuals are usually attributed to genetic differences. In this talk we intend to investigate to what degree differences in personalities may result from differences in learning and experiences. We use an individual-based model to generate such an explanation for the experimental findings of personalities in perch by Magnhagen & Staffan (2005). In small groups of perch, the time in an open area, close to a predator, and frequency of prey attacks were correlated, and this correlated trait was used to distinguish different personality types. In our model, we have replicated the experimental procedures and data analysis of this empirical study. The modeled individuals were completely identical, but adjusted their behaviour by habituation and by social facilitation. Personalities arise that strongly resemble those found in real perch. They are due to differences in habituation towards the open area, because, by chance, different animals collect different experiences. These different experiences are in part determined by the habituation speed of group mates through social facilitation. Similar to the empirical data, behavioural syndromes are stable for several trials. We conclude that it is valuable to consider experience and learning more often as an explanation for personality differences in animals.

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## Visual learning and sensory generalization by poultry chicks.

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Pavlov conceived sensory generalization as being due to spread of excitation in neural networks. That is an essentially passive process akin to, say, blurring in optics. Pavlov's model, as elaborated by Spence in the 1930's, has remained the basis for most current modelling of generalization behaviour. These models are supported by relatively little experimental data, but amongst the most influential studies were those done on pigeon colour vision in the 1950's and 60's. In our experiments poultry chicks learn colour more quickly and accurately than has been reported for pigeons. We will describe how chicks that are familiar with two colours subsequently generalise to novel stimuli, and what they learn in their first encounter with an new object. Contrary to predictions of models such as Pavlov's and Spence's chicks readily discriminate between familiar and novel stimuli and A) that their initial responses reflect their knowledge about how natural stimuli (or objects) vary and B) that the rate of learning about the novel is much greater than for familiar stimuli. Both these observations imply that chicks make efficient use of available information about stimuli. Our observations are inconsistent with Pavlov's view that generalization is essentially a passive process that is closely related to discrimination, and suggest that models of this kind should be used with caution.

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## Spot or not? Individual variation in the density of black melanin-based skin spots reflect stress coping style in salmonid fish

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Salmonid fish are intriguing and fascinating to both researchers and laymen, on account of their biological characteristics and wide use in fishing and aquaculture. In particular, salmonids are known for extensive genetic and life-history variation, which arise through homing with sub-populations localized and adapted to different sites and environments within a water system. Within populations, genetic and epigenetic factors interact to shape individual reaction patterns, conferring variable vulnerability to stress and disease. Here we show that heritable variation in behavior and physiology is reflected in the visual appearance of both Atlantic (*Salmo salar*) and Pacific species (*Oncorhynchus mykiss*). Salmon and trout skin vary from immaculate to densely spotted, with black spots formed by eumelanin-containing chromatophores. In both species, more spotted individuals show a much reduced corticosteroid response to stress, along with typical pro-active behavior such as social dominance and increased boldness in new environments. Corticosteroid suppression of immune function provides a novel link between melanin based coloration and disease resistance. Furthermore, this visual manifestation of alternative coping styles can elucidate the evolution of animal personalities, conveniently revealing frequencies of occurrence in different environments and response to selective pressures.

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**Springtail hunters of different levels of intelligence:  
behavioural versus cognitive specialization**

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Springtails are abundant in the litter-soil stratum in various landscapes throughout the world. They are equipped with a jumping “fork” enabling them to escape predator’s attacks. Thus far only several tropical ants species, equipped with trap-jaws, were considered specialized springtail hunters. Field experiments in which live springtails were placed into glass containers with transparent substrate revealed efficient springtail hunters in mass litter dwelling invertebrates in humid regions, that is, in ants (*Myrmica rubra*, *Lasius niger*, *Tetramorium caespitum*) and in Staphylinidae beetles. Among them only *M. rubra* appeared to use goal-seeking behaviour and sufficiently specific hunting tricks. Developmental laboratory studies showed that *M. rubra* are able to improve their hunting technique whereas beetles are not. In beetles there are three constant groups demonstrating distinct types of behaviour relative to jumping victims: good hunters that catch a victim from the first spurt; poor hunters that perform several wrong spurts, and non-hunters that are not interested in springtail hunting at all. In ants hunting behaviour surprisingly includes elements of social learning and different levels of flexibility. This can be considered cognitive specialization in *Myrmica* ants versus “freezing” behavioural specialization in populations of beetles. Field observations demonstrated that intelligent hunting allows *Myrmica* ants to switch to springtails as a mass prey.

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## Incidental leaders and naïve followers in sheep

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In gregarious species, where group composition is unstable, it is a challenge to understand which individuals take the decision to initiate movement and how a collective decision to follow emerge. We tested the hypothesis that any individual in a group could trigger a collective movement. We performed a series of experiments with Merino sheep (*Ovis aries*), a highly gregarious vertebrate. An experimental design was set up to control the movement departure of several sheep. We show that trained sheep when stimulated initiate systematically a movement, and triggered a collective movement of 3 naïve group members. This was not observed in control groups containing 4 naïves. Trained ewes when departing simply raised their head and move readily toward a visual target. Our results suggest that, provided they exhibit this social cue, any individual in a group could trigger a collective movement, turning itself an incidental leader. We have no indication of recruitment before departure and during movement. We suggest new experiments to test how the social context and behavioural state of individuals by the time of departure modulate the collective decision to move.

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**Look who's watching: cleaner fish *Labroides dimidiatus*  
adjust audience effects to the quality of bystanders**

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Cleaners *Labroides dimidiatus* increase service quality to current clients in response to image-scoring clients. The advantage of such amendments is that cleaners gain access to the observers. Are these audience effects fixed behavioural patterns or do cleaners fine-tune their behaviour? If they do, they should increase service quality in particular if the bystander is an attractive food source relative to the current client. To test this idea on 21 cleaners two Plexiglas plates of different size with differing amounts of food on them were presented to cleaners either alone or in the presence of the other plate. Plates contained preferred prawn items (mimicking client mucus) and less preferred flake items (mimicking client ectoparasites) and were removed immediately in response to cleaners eating prawn. In the two-plate situation, cleaners could gain access to the 'observing' plate by eating only the less preferred food off the accessible plate. I found that cleaners feed more against their preference if they thereby gain access to a large additional food source but not if they would gain access to a small additional food source. In a second experiment, I found that cleaners are even capable of refraining completely from feeding on the first Plexiglas plate, producing fake bites or tactile stimulation with their fins instead. The results show that cleaners are remarkably fine-tuned in their foraging decisions and hence levels of cooperation.

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## Host manipulation by parasites: genetic and epigenetic aspects

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An animal's phenotype, i.e. its body and how it behaves, serves as vehicle for its genotype. However, animals are shared vehicles carrying numerous other genomes, eg parasites. Because the transmission success of many parasites is tightly coupled to host behaviour, it is not surprising that selection has favoured parasites capable of usurping control of host behaviour. This ability provides some of the best examples of the concept of the extended phenotype: genes inside one organism having phenotypic effects on another organism. I will address two recent developments in its study. First, I will discuss whether the ability to manipulate the host is a species trait, or whether it is genetically variable. Certain parasite species are referred to as manipulative, as though all individuals adopt an identical manipulative strategy. I will show that manipulation of host behaviour may be only one of several strategies: while some parasite genotypes induce phenotypic changes in the host, other genotypes don't, and benefit freely from the actions of manipulative genotypes. Second, I will turn to the mechanisms underlying parasite-induced changes in host phenotype, and argue that in many cases these may be the outcome of epigenetic effects. Several lines of evidence suggest that parasites affect host gene expression; these changes in host phenotype may even be manifested in subsequent host generations. These are just two of the new directions in this exciting research area.

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### **Grooming patterns and reconciliation in primates: a minimal model.**

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Primate social behaviour has been explained with help of several theories that rely on sophisticated cognitive processes such as keeping track of acts, and monitoring each others relationships. However, evidence for such cognitive activities in monkeys is weak. Therefore, there is an increasing interest in explanations that are embodied and contextual. Here, we use an individual-based model to generate such explanations for the distribution of grooming in primates. In our model, individuals are located in space, they group and have a tendency to fight and groom. They are initially completely identical. Their fighting capacity depends on the self-reinforcing effects of winning and losing fights, upon encounter, they decide whether or not to fight depending on the risks involved. If fighting seems too risky, they will groom. We show that using merely these two cognitively simple rules, grooming behaviour is distributed like in real primates: grooming is reciprocated and fights are reconciled. Furthermore, if we tune the model to a despotic dominance style rather than an egalitarian one, individuals appear to reconcile less often, direct grooming up the hierarchy and groom most frequently those of similar in rank. The resemblance of these grooming patterns to those in real primates is striking and suggests that their grooming patterns may arise as a side-effect of social-spatial structure rather than social cognition. This leads to hypotheses to be tested in primates.

## Natural selection on personality traits

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Personality traits provide a framework for investigating several key issues in evolutionary biology. These include identifying the adaptive significance of individual behavioural variation and exploring whether environmental heterogeneity can explain the maintenance of behavioural variation. Estimating natural selection is central to tackling these issues and in this introductory talk I will, first, outline how natural selection is defined and estimated by evolutionary ecologists. Second I will summarise the findings of recent reviews that looked for evidence of selection on personality traits. Third I will discuss some of the main constraints that researchers are faced with in this emerging field and ask whether natural selection in all ecologically relevant behavioural contexts can realistically be measured in a single population.

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## Decision-making in group departures of juvenile domestic geese

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Group-living animals have to find trade-offs in order to reach consensus and travel together. We investigated the recruitment processes underpinning decision-making at departure in a group of twenty female domestic geese (*Anser domesticus*) kept in semi free-ranging conditions. Two observers continuously videotaped the behaviours of the birds. Data were analyzed using multiple regression analyses. Departure was preceded by an increase in the arousal state of group members and their initial orientation influenced recruitment. A higher number of vocalizations and arousal behaviours led to a larger number of individuals recruited. The context before departure also influenced recruitment processes. Cues provided by individuals' locations, moves and signals appeared more operative following resting periods compared to periods of activity, associated to higher levels of interference. Patterns of group movement were predicted from the behaviors of individuals before departure. Some individuals were more efficient than others in recruiting followers but any geese could initiate a movement. The first mover recruited a higher number of mates when it had a greater number of neighbours. Not only the first mover but also subsequent birds' behaviours prompted further individuals to follow. We conclude that decision-making in geese is a continuous and distributed process during which birds synchronize and adjust each other's motives until reaching a consensus.

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*Notes*

**When should the worm turn?**  
**The evolution of host manipulation strategies in parasites**

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Many experimental studies have shown how parasites manipulate their intermediate hosts in order to increase their likelihood of transmission, through making them more obvious to their predatory definitive hosts. However, little attention has been paid to how manipulation strategies have evolved in so many different groups of parasites, and a unifying theoretical framework of parasite manipulation behaviour is lacking. Here, we present a game-theoretic model that considers when and how parasites should manipulate their host. We show that many mixed parasite strategies are possible, particularly where there is a low cost to manipulation, or if manipulation increases the likelihood of a parasite reaching its correct definitive host. Therefore it is possible for cheats or "hitch-hikers" to evolve, which do not manipulate the host themselves, but instead rely on another co-infecting parasite to pay the cost of manipulation. This may mean that the detection and quantification of manipulation in the field may be made difficult by the wide diversity of strategies that are possible. Furthermore, the consequences of such manipulation behaviour on the dynamics of the intermediate and definitive host populations and the prevalence of infection may be unpredictable. This framework reveals that many parasite manipulation strategies are possible, allowing the exploration of new facets of parasite behaviour."

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*Notes*

## Mating behaviour and parasite – host interactions in male columbian ground squirrels (*Spermophilus columbianus*)

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Parasites are a crucial evolutionary driving force with regards to sexual selection. Many studies have investigated the effect of parasites on mate choice, reproductive success, life history and the immune system. In 1982, Hamilton and Zuk proposed in their seminal paper that animals should choose parasite-free or parasite-resistant partners to obtain “good genes”, in order to improve parasite resistance in their offspring. We tested this hypothesis on a wild population of Columbian ground squirrels (*Spermophilus columbianus*). We manipulated parasite infestation and tested whether reduced parasite loads on male ground squirrels had an effect on female mate choice and male reproductive success. While we found some effect of reduced parasite load on the number of male mating, this did not translate into an increased reproductive success. In addition, there was no measurable effect of parasite removal on body condition. Untreated males copulated more often first with receptive females. A paternity analysis revealed a first male advantage in siring offspring. In conclusion, the mating order seems to be a central factor in male mating success and hence provides females a way to exert mate choice. The potential role of genetic quality and parasite infestation for female mate choice and male reproductive success will be discussed.

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Notes

## Understanding cognition needs proper comparative study

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Comparative study of cognition and brain is complicated by the fact that multiple functions and multiple brain regions may be involved in a particular behaviour, and that a single brain region may be involved in multiple behaviours. Moreover, behaviour is an outcome, not a mechanism, and thus a variety of neural, genetic, and psychological cognitive mechanisms can underlie a particular behavioural act like food storing, behavioural innovation, tool use, or social learning. The arbitrary separation of sensory and motor processing from ‘cognitive’ processing may be misleading, with a focus on functional systems more likely appropriate. Such problems may be reduced by a focus on smaller brain areas or well understood behaviours, but are by no means eliminated. Despite these concerns, I will argue that comparative studies are vital in aiding understanding of the co-evolution of brain and cognition, particularly when findings are repeated across different taxa, when potential confounding variables or covariates are addressed, and when the analysis covers many species and explicitly incorporates phylogeny. I will present primate data that support the idea that multiple cognitive measures have co-evolved together and co-vary with neocortex volume, supporting a general process view of cognition and making testable predictions for laboratory or field experiments.

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*Notes*



## Personality and degrees of specialisation

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The main objective of personality studies is to determine if individuals show some behavioural consistency over time and across situations. Studying personality is thus generally done by estimating the repeatability of a behaviour trait and by calculating the average value for that trait for each individual as an index of personality profile. However, by doing so we ignore that individuals can also vary in their degree of specialisation. Here we consider that the degree of specialisation of an individual for a given trait corresponds to the range of phenotypic expression of that trait for that individual relative to its population. A specialist for a trait is limited in its range of expression of that trait relative to its population. While a generalist expresses the whole range of phenotypic variation observed for that trait in the population. We suggest that studies on personality should include not only individual variation in the average value of a trait but also a measure of the degree of specialisation of each individual. We show some methods that could allow us to estimate the degree of specialisation of individuals.

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*Notes*

## Temporal complementarity of leadership in shoals of golden shiners

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In large laboratory tanks, it is possible to teach golden shiners (*Notemigonus crysoleucas*) when and where food becomes available. Then, after a majority of naïve fish has joined a small minority of informed fish, the latter act as leaders and take the whole group to the food corner at the right time of day. In this context, followers can be viewed as scroungers of the leaders' knowledge (though they also provide leaders with the protection of a large shoal). In 1984, Giraldeau proposed that participants in producer-scrounger systems could exchange roles and create a "skill pool effect". Applied to golden shiner shoals, this idea translates into the possibility that individuals with different knowledge could exchange leadership roles throughout the day. I will present preliminary results from experiments in which fish trained to expect food in one corner in the morning were joined by fish expecting food in another corner in the afternoon. The resulting shoal, in the absence of any food, did spend more time in the morning corner during the morning and in the afternoon corner during the afternoon. However, there was still a fair amount of sampling of the non-food corner at both times of day, possibly indicating a small cost of travel within the tank. The possibility remains that in cases where leadership is motivated by foraging, and foraging is influenced by prior knowledge, leadership positions may be occupied by different fish at different times of day.

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*Notes*

**Testing ring species predictions;  
vocal variation in a parrot, *Platycercus elegans***

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Geographical variation in signals, such as vocalisations, are important in population divergence. Ring species, where two distinct forms are connected through a ring of intergrading and intermediate populations that meet around a geographical barrier, provide a rare opportunity to study speciation processes. We studied vocal variation of the crimson rosella ring species complex (*Platycercus elegans*), which is characterized by striking geographical variation in plumage colour, from crimson to pale yellow. We recorded calls throughout the range and conducted playback experiments to test the hypotheses that (i) calls differ in ways concordant with the colour variation, and (ii) the geographically terminal and most divergent forms respond differently to each others calls. We assessed call duration, peak frequency, fundamental frequency and frequency modulation of contact calls. Results showed distinct vocal differences, particularly in the variables fundamental frequency and frequency modulation, at multiple biogeographical levels ranging from local populations to subspecies level. However vocal variation was not as predicted within a ring species. Furthermore, at multiple sites across the zone of secondary contact, playback experiments suggest that the two most divergent forms in the ring respond indifferently to calls from the two forms. How these findings accord with predictions from the ring species hypothesis are discussed.

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*Notes*

## **Communicating effectively through a busy sensory channel: possible through the use of multiple signals?**

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Communicating effectively in the constant background noise that characterizes natural environments constitutes a real challenge, and particularly so in the context of breeding choruses in which dozens of conspecific males signal simultaneously. Several studies have demonstrated that in chorusing species female ability to discriminate male calls in simple 2-stimuli phonotaxis tests disappears in more complex acoustic conditions. This has led to the assumption that accurate mate choice does not take place in dense choruses. However recent reviews have stressed that communication seems to be widely based not on single- but on multi-component signals that contain complementary or redundant information. By increasing the information gained and decreasing the time necessary to perceive it, the use of such signals is predicted to enable efficient communication in busy sensory conditions. The aim of this study was to test this hypothesis in the case of the European treefrog *Hyla arborea*. We first demonstrated that, unlike in simple acoustic conditions, in a more realistic acoustic context females were no longer able to discriminate attractive calls on the basis of a single call component. In the same conditions, we then tested female capacity to identify and locate a call presenting multiple attractive components. The results strongly suggest that the use of multiple signals may be the key to effective mate choice within constraining acoustic conditions such as choruses.

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*Notes*

**Social organisation, mating system and ranging behaviour  
of Eurasian badgers in an urban environment**

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Although urbanisation is a major cause of biodiversity loss, some species ('urban adapters') can achieve high local population densities in urban environments. In the UK, badgers *Meles meles* are becoming increasingly frequent urban residents, leading to conflict between householders who encourage them and others who consider them a nuisance. However, little is known about the behaviour of urban badgers and there is no agreed strategy for managing badger-related problems. We investigated social organisation, mating patterns and ranging behaviour in a population of badgers in Brighton, UK, using radio-telemetry together with genotyping of remotely collected DNA. Like rural badgers, urban badgers lived in stable, mixed-sex social groups containing, on average, 4.1 adults. However, population density was higher than in most rural populations owing to urban group home ranges being the smallest ever recorded in this species (mean = 4.8 ha). Rates of extra-group paternity and of between-group movements were also high in the urban population and there was no evidence of territory defence. We attribute the differences between rural and urban populations mainly to differences in the availability of food (especially anthropogenic food). We conclude that the responses of badgers to urbanisation resemble, in most respects, those of other mesocarnivore 'urban adapter' species. From a management point of view, we recommend that householders be dissuaded from feeding badgers.

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*Notes*

**Is brood size related to male quality and androgen levels  
in the peacock blenny?**

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In the south of Portugal males of the peacock blenny, *Salarias pavo*, breed in dense aggregations in artificial reefs on intertidal sand flats. These males readily accept new nest opportunity when offered in the form of transparent tubes. This offered the opportunity to test how individual characters and androgens interact in the regulation of brood size. To test these interactions, brood size manipulations were carried out by swapping nests of males brooding in transparent tubes. Indicative for a stimulating role of brood size on female spawning, broods remained relatively small in the reduced group and large in the enlarged group. On the other hand, brood sizes in both reduced and enlarged groups tended to return to original unmanipulated numbers indicating that some character of the males affected brood size. Testosterone but not 11-ketotestosterone levels were found to be positively correlated with brood size. Relative to this positive trend with testosterone, males with experimentally enlarged broods showed lower testosterone levels than expected while males with experimentally reduced broods had higher testosterone levels than expected. Further experiments in the field should reveal to what extent these opposite trends in testosterone production are related to changes in the male's behaviour and are involved in the regulation of brood size.

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*Note*

**Comparative studies of brain size:  
what have we learned and where next ?**

**Rowe C.**

Abstract not received

## Does tasting the difference make a difference?

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When we think of aposematism, we predominantly think about conspicuously coloured prey advertising their potent toxins to predators. But many aposematic prey often have additional defences, including sounds, odours and behavioural displays, which they produce upon attack. Another common response to an attack is to exude chemicals, which would potentially allow the defences to be tasted directly by the predator, enabling a judgment to be made upon its acceptability as a prey item prior to ingestion. Defence secretion and subsequent taste-rejection by predators allows prey to escape, and perhaps allow the evolution and maintenance of aposematism by individual selection. Taste may also be advantageous in mimicry systems where predators attempt to discriminate among similar-looking prey with variable defences. In this talk, we explore some of our recent findings on taste-rejection by avian predators on artificial and live prey. We will highlight the need to consider the role of secretions and taste-rejection in prey selection, and the implications for our studies of prey defences.

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## Exploring the alternative causal explanations for the existence of aposematic signal mimicry

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The classical and widely accepted explanation for aposematic signal mimicry between defended prey, known as Müllerian mimicry, focuses on the benefits of sharing the mortality costs of predator education across defended species. It has been argued, however, that as originally formulated, this classical Müllerian explanation may play at best a minor role in explaining resemblance between such defended species. Here we present a study using wild caught Great tits (*Parus major*) as predators in the Novel world, to test alternative explanations of signal mimicry. We tested the general prediction that the per capita attack rate between two defended prey is decreased by signal mimicry during the predator's period of learning, and also whether this held when the birds were experienced. We found that attack rate between defended mimetic prey was only decreased during learning, and not by experienced predators. As Müller's original argument assumes no interaction in the harm done to predators between sympatric defended forms that do not share warning signals, we also tested whether Great tit's avoidance of defended species was heightened a) in the absence of signal mimicry (a defensive mutualism) and b) between visually similar prey with different defensive chemicals. We found there was no enhanced survival for focal defended prey when accompanied by another defended prey without signal mimicry, or with multiple chemical defences.

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## Effects of early exposure to gonadal steroids on behavioural and brain lateralization in a fish species

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Lateralization of brain and behaviour affects a wide array of important functions and is a fundamental aspect of the behavioural organization among vertebrates. Since the publication by Geschwind and Galaburda in 1985 the hypothesis that early exposure to testosterone affects brain lateralization in humans has received a lot of debate. However, a proper experimental test of this hypothesis in an animal model has hardly been undertaken. Many fish species show behavioural lateralization and we investigated the effects of early exposure to methyl-testosterone (T) and 17 $\beta$ -estradiol (E2) on behavioural and brain lateralization in the cichlid fish *Aequidens rivulatus*. Young fish at the age 12-20 weeks were treated with T or E2 or the solvent alone and tested them at the age of 20 weeks in two behavioural lateralization tests (detour and rotational preference). The brains were collected to establish brain lateralization and tissue was taken to determine the hormone levels in the fish. Data are currently analysed but preliminary results show that (1) E2 enhances the strength of behavioural lateralization; (2). Even control fish show strong brain lateralization in the size of the habenula area.

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## Extended Phenotype as Signal

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Animal signals may not be part of the performer, but instead result from construction behaviour. Like any bodily ornament, such extended phenotypes can provide conspecifics or heterospecifics with essential information in various social contexts. We explore the potential benefits of an extended phenotype with a signalling function as compared to a bodily ornament or behavioural display. Their independence of the body, the persisting physical presence and the morphological and cognitive requirements involved allow unique communication possibilities. We present a concept to classify the various levels of information transfer by extended phenotype signals. In the process, we explore the differences between secreted extended phenotype signals and extended phenotype signals resulting from collecting behaviour, which can involve much higher behavioural complexity. We examine the evolutionary perspective of extended phenotypes with a signalling function and sketch possible pathways how they might evolve. Comparing species utilising extended phenotypes as signals with closely related species suggests that constructions may often first provide a direct fitness benefit, with a signalling function becoming more and more prominent during evolutionary progression. The abundance and variability of extended phenotypes as a signal is impressive and they provide unique possibilities in animal communication and for its study.

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*Notes*

## Implications of individual temperament in a cooperative task

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In recent years, an increasing number of studies demonstrated the existence of personalities in a wide range of animal species. There is a growing body of evidence showing that individuals differ in their extent to take risks, to explore new environment or to react to stressful situations. This variation in temperament has been related to differences in learning abilities or performance in cognitive tasks. In the present study, we attempted to identify the implications of variations in individual temperament on performance in a cooperative task in rooks (*Corvus frugilegus*). The birds were tested individually to measure a number of personality parameters. In parallel, we conducted a cooperative string pulling task in which birds were tested in dyads. Results showed that successful cooperation depended to a large extent on the temperament of the two partners involved. Bolder individuals appeared to be more willing to participate in the task, whereas shyer individuals were more influenced by the behaviour of their partner. These findings suggest that individual temperament may influence the patterns of cooperative actions in animals. Moreover, inter-individual variation in behaviour may play an important role in the evolution and maintenance of cooperation (McNamara *et al.* 2004).

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*Notes*

## **Endocrine control of alternative male reproductive tactics in a small mammal**

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The endocrine control of alternative male reproductive tactics has been studied in detail in several fish and reptilian species but we know little about this phenomenon in mammals. I studied ecological reasons and endocrine correlates of alternative male reproductive tactics during 6 years in a field study in the South African striped mouse. Males of the striped mouse can follow one of three different tactics: 1. Paternal group-living breeders, 2. alloparental philopatric group-living males or 3. roaming non-paternal solitary males. Which tactic is chosen depends on population density and on male competitiveness, with older and larger males being breeders, medium old males being roamers and small young males being philopatrics. Thus, male striped mice follow a conditional strategy and can switch tactics during their life. Prolactin, a hormone known to be associated to paternal care, was significantly higher in paternal breeders than both in philopatrics and in roamers. Roamers had the highest testosterone levels, potentially promoting risky behaviour such as invading other territories. Philopatric males had the lowest testosterone levels indicating physiological sexual suppression. Philopatric males had ten times higher corticosterone levels than both breeders and roamers, indicating that philopatry due to habitat saturation is stressful. Different tactics were associated to differences in hormone levels, supporting the relative plasticity model in a small mammal.

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*Notes*

### **Adventurous zebra finch partnerships make for better parenting**

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The evolution and maintenance of consistent behavioural differences between individuals (personalities or behavioural syndromes) is becoming a major research focus in behavioural ecology. Here we present evidence of a role for sexual selection in the evolution of exploratory personality differences in zebra finches, *Taeniopygia guttata*. In a breeding experiment, pairs of individuals that were both rated as highly exploratory before pairing fostered heavier offspring than pairs of unmatched or less adventurous individuals. However, the exploratory tendencies of genetic parents had no influence on brood success. We discuss these findings from the perspective of the food provisioning abilities of the different behavioural types and how they interact during biparental care.

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## Similarity of socio-positive relationships between adult pair partners and between juvenile nestmates in jackdaws (*Corvus monedula*)

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Jackdaws (*Corvus monedula*) form pair bonds already in their first year. These bonds are usually monogamous and last for life. We here analyse whether the relationships between adult pair partners are similar to those between juvenile nestmates in a handraised and captive group of 36 jackdaws. The analysis is based on two years of behavioural focal observations and one year of ad libitum observations and divided into two periods: juvenile and adult. Analysed parameters were: a) physical proximity (nearest neighbour, sitting close), b) physical contact (touching, allopreening), c) object related interactions (approaching a conspecific that is manipulating an object, joint manipulation of an object), d) food related interactions (approaching a conspecific that is manipulating food, food-sharing), and, e) agonistic interactions (severe aggression, pecking). Adult birds showed significantly higher frequencies or longer durations of behaviours a) to d) with their pair partner than with others, whereas e) did not differ significantly between pair and nonpair partners. The same was true for juvenile birds showing significantly higher frequencies or longer durations of behaviours a) to d) with their nestmates than with non-nestmates, whereas e) again was not significantly different between nestmates and non-nestmates. Our results suggest that socio-positive relationships between juvenile nestmates are qualitatively similar but quantitatively different than between adult pair partners.

**Low social motivation favours social bonding  
in young Japanese quail (*Coturnix japonica*)**

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In quail, little is known about relationships between familiar conspecifics. Here, we assessed the effect of social motivation on attachment between 2 partners in 1-week-old Japanese quail. In experiment 1, the behaviour of quail selected for a high (HSR) or low (LSR) social motivation was recorded after 1 week of pair contact during 3 successive 10-min-situations: basal, separation, return of the cagemate. In experiment 2, similar procedure was used. Paired quail were separated and responses to the introduction of the familiar (F) or an unfamiliar (U) bird were compared. In experiment 1, basal activity was similar in both lines and return of the cagemate induced return to basal activity. During separation HSR quail jumped, paced and emitted distress calls more than LSR ones ( $p < 0.001$ ). In experiment 2, these behaviours decreased upon return of the F and the U bird in both lines ( $p < 0.05$ ). In LSR quail time in contact and non aggressive pecks were higher for the F than for the U bird, but aggressive pecks were higher for U birds ( $p < 0.05$ ). In HSR quail, their responses to the F vs the U bird did not differ significantly except for more aggressive pecks toward the U vs the F bird ( $p < 0.01$ ). Therefore, young quail of both lines were affected by social separation but disturbance in LSR quail was lower. Moreover, HSR and LSR responses to social reunion with F and U partners suggest that attachment responses to the F partner is stronger in LSR quail than in HSR ones.

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## Famine Relief in Ant Colonies

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Resource distribution is a fundamental aspect of social organisation, but it poses a dilemma. How to facilitate the spread of useful resources but restrict harmful substances? This dilemma reaches a zenith in famine relief. Survival depends on distributing food fast but that increases vulnerability to poisons. Ant colonies are a prime model system for addressing these questions. We studied the distribution of honey solution after 48 h of starvation compared to normal conditions in four individually marked *Temnothorax albipennis* colonies. 95% of the workers received food within the first 30 min of famine relief and distribution was an order of magnitude faster compared to the control. Most of this acceleration was due to the increase in the number of donors that had been receivers. Our data were well fitted by a simple analytical model based on complete mixing of donors and receivers. This is intriguing because ants divide labour and *T. albipennis* workers also have spatial fidelity zones. Food distribution had two phases. First, ants moved closer to the exit where foragers entered with food. Second, foragers penetrated further into the nest and donated to brood workers. We discovered that the heightened colony vulnerability to poison during famine relief might be mitigated by the uneven spread of food and the existence of ‘silos’. These are expendable foragers, who stay inside the nest and store food during famine relief, thus acting as potential testers for food toxicity.

## Host manipulation in the world of dead-end predators

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The ability of trophically transmitted parasites to predispose their hosts to predation by altering host phenotype is usually considered as a parasite strategy evolved to increase the probability of successful transmission. However, the adaptive value of manipulation is not clear as it may be associated with costs, such as increased susceptibility to predators which are unsuitable next hosts for the parasites. Here I present results from both empirical and theoretical studies investigating the role of non-host predation in evolution of host manipulation. First, I show how manipulation by an acanthocephalan parasite predisposes its isopod hosts to predation both by target and non-host species. However, because manipulation increases host vulnerability to predation more towards target hosts, it is likely to enhance parasite transmission. Second, I formally show that even in systems where manipulation predisposes hosts mainly to predation by non-host species, manipulation can still be advantageous for parasites. This is when manipulation increases the general predation vulnerability of infected hosts enough to compensate the costs due to non-host predation. Potential for this, however, depends on predation pressure without manipulation.

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*Notes*

**Parasite Manipulation of brain monoamines in California killifish (*Fundulus parvipinnis*)  
by the trematode *Euhaplorchis californiensis***

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California killifish (*Fundulus parvipinnis*) infected with the brain-encysting trematode *Euhaplorchis californiensis* display conspicuous swimming behaviors, which render them more susceptible to predation by avian final hosts. Heavily infected killifish grow and reproduce normally, despite having thousands of cysts inside their braincases. This suggests that *E. californiensis* affects only specific locomotory behaviors. We hypothesized that changes in serotonin and dopamine metabolism essential for controlling locomotion and arousal may underlie this behavior modification. We employed micropunch dissection and HPLC to analyze monoamine and monoamine metabolite concentrations in brain regions of uninfected, naturally infected and experimentally infected fish. Parasites exerted density-dependent changes in monoaminergic activity distinct from those exhibited by fish subjected to stress. Specifically, *E. californiensis* inhibited a normally occurring, stress-induced elevation of serotonergic metabolism in the raphe nuclei. This effect was particularly evident in experimentally infected fish, whose low-density infections were concentrated on the brain stem. Parasites were also associated with decreased serotonergic activity in the hippocampus and increased dopaminergic activity in the raphe. In conclusion, altered monoaminergic metabolism may explain behavioral differences leading to increased predation of infected killifish by their final host predators.

## **Species differences in executive function performance correlate with neocortex and total brain size across non-human primates**

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A recent plethora of papers have been published documenting relationships between (relative) brain size in vertebrates and a variety of behavioural characteristics and ecological trends. However, a fundamental criticism of these papers is that by their nature they identify correlations between a physiological trait and an ecological or behavioural measure and cannot, by their nature, identify causality. Here, as a more direct test of the relationship between brain size and cognitive ability, we compare performance data on five core executive functioning tasks with measures of brain size and architecture. We demonstrate that there is a robust positive relationship between performance measures and overall brain and neocortex size, whereas there is no relationship between performance and subcortical structures. There is considerable variation in the strength of this relationship between tasks, with short-term memory and reversal tasks being more strongly associated with brain size measures than oddity and transference tasks. We discuss these results in the context of both previous comparative studies of primate brain size and species ecological and behavioural traits.

## How do birds decide what to eat?

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It is classically assumed that the actions of naïve predators generate selection for aposematism and mimicry. One reason for this is that predators are often assumed to totally avoid toxic prey once they have learned to associate the visual signals of aposematic prey with the noxious effects of the toxins that the prey possess. However, it has recently been demonstrated that this is an over-simplistic view of predator cognition. In this talk I will briefly review the data suggesting that predators make strategic-decisions to eat prey they know to be toxic, identify factors that are likely to influence the strategic foraging decisions of educated predators, and discuss how this view of prey selection makes novel predictions about the evolution of prey defences.

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*Notes*

## Brain size and the body size diversification in birds

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Large brains are associated with increased cognitive skills, enabling animals to explore and utilize new environments and resources more successfully. Such behavioral flexibility is theoretically expected to have macro-evolutionary consequences. First, populations of big-brained individuals should more easily become established in new locations, increasing opportunities for allopatric speciation, and decreasing chances that the species as a whole goes extinct. Second, the ability to use new resources places new selection pressures on populations, promoting adaptive diversification, a process termed “behavioral drive”. Here, we show that the average brain size of a bird family is associated with the rate of morphological diversification within the family. The association is independent of the number of species in the family, geographic range and correlates of speciosity, providing the first support for the importance of behavioral drive in evolution.

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*Notes*

## Behavioral and physiological mechanisms underlying parasite-related mating suppression in an intermediate host (Isopoda)

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The aquatic isopod *Caecidotea intermedius* is an intermediate host for the acanthocephalan *Acanthocephalus dirus*. Development of *A. dirus* into the cystacanth stage correlates with suppression of male mating behavior in *C. intermedius*. We have used a combination of field-based and lab-based approaches to examine variation in both the physiology and behavior of *C. intermedius* to gain insights into the mechanisms that could underlie parasite-related mating suppression. These studies have revealed the following relationships. First, mating behavior is energetically costly and typically occurs in refuge. Thus, infected males that experience mating suppression do not pay the energy costs of mating and spend more time in the open than uninfected males. Second, mating suppression correlates with an increase in stored energy (glycogen, lipid) for infected males compared to uninfected males. Third, infected males that do not mate also feed less than uninfected males. We propose that these results are consistent with the interpretation that *A. dirus* suppresses the mating behavior of *C. intermedius* as part of a strategy of host manipulation. Specifically, mating suppression could allow for both mating-related energy to be reallocated towards maintenance of the host, and for males that would typically be in refuge to remain in the open where they could be seen by visually-hunting predators. In this way, *A. dirus* could increase the probability of transmission to definitive hosts.

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## Recruitment mechanisms and behaviours in a gregarious raptor species

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Group living is associated with costs, such as competition for food, but also with potential benefits, such as a decreased predation risk, as earlier predator detection and/or higher defence efficiency. Recruitment and mobbing have been viewed as active anti-predator strategies leading to group defence, but have mainly been investigated at an interspecific level and in relation to group size. Very few studies have evaluated individual investment and characteristics in mobbing behaviour so far. In this study, we tested communal defence and mobbing behaviour in a gregarious raptor, the Marsh harrier *Circus aeruginosus*, which roosts on the ground, being therefore vulnerable to several predators. By using predator decoys of varying dangerousness, we assessed experimentally whether communal roosting enhanced predator defence through increased detection. We then focused on the mechanisms and specific behaviours involved in recruiting mobbers, and whether individual characteristics differed between individuals that detected the predator, individuals that tried to recruit mobbers, and mobbers. Individual characteristics included sex, age and plumage colour type (this species is polychromatic). We found that communal roosting increased predator detection, that detection rate was modulated by predation risk, that recruitment was enhanced by alarm calling, and that mobbers and recruiters differed by sex, age and colour type.

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*Notes*



## **Fearful symmetry revisited: the protective value of conspicuous signals is not impaired by asymmetry in the field**

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Conspicuous signals enhance the rate of predator avoidance learning of unpalatable prey, and/or promote spontaneous avoidance in naïve predators. This effect may be greatest when prey markings are highly symmetrical, supported by aviary studies using stimuli either symmetrical or asymmetrical for shape, size and colour. However, previous findings may be confounded by certain experimental and prey features, and no study has directly investigated the effect of asymmetry on conspicuous signals in a natural setting, where viewing distances, angles, predator species, and light conditions vary. We undertook two field experiments with artificial grey-scale prey, marked with a pair of white markings presented to wild avian predators, to test the effect of symmetry on the survival value of conspicuous signals in an ecologically relevant situation. Experiment 1 had treatments with symmetrical spots, or with spots asymmetrical in area between 5 and 50 percent. All marked treatments survived better than unmarked controls, but there was no benefit of being symmetrical and targets with intermediate asymmetries survived best. Experiment 2 tested the benefit of possessing markings symmetrical for shape (circles or squares) and distance of the markings from the midline. Again, symmetry conferred no benefit; targets with markings asymmetrical for position or shape survived as well as those with symmetrical arrangements. We discuss the implications of these results.

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## Behavioural pair synchrony modulates hormonal stress response in Great tits (*Parus major*)

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The presence of social allies may buffer adverse consequences of social stress. This has mainly been demonstrated in mammals and recently also in birds. The behaviour of the social allies may have an important impact on the extent of this buffering effect. We therefore investigated the influence of social context on the hormonal response after handling stress in Great tits (*Parus major*) selected for fast and slow exploration. We tested 16 male-female pairs (8 fast-fast pairs, 8 slow-slow pairs) after the breeding season. We handled the females for 2 min and thereafter observed their behaviour and collected droppings for the following 2 h with their mate being either present (a) or absent (b) when the female came back to her home cage. As control the same females were not handled prior to observation and their mate was present. We measured excreted immunoreactive corticosterone metabolites (CM) using an enzyme immunoassay. Females of both lines excreted higher CM in response to handling in both conditions (a,b). While fast females showed increased activity, slow females sat close to their mates longer after handling compared to control days. Pairs resting and feeding synchronously in test (a) and in the control condition excreted lower CM, than asynchronous pairs, irrespective of their personality type. These results show that depending on behavioural phenotype birds increased social proximity after a stressful event and that pair synchrony may modulate amounts of excreted CM.

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## True vote to choose the direction to move in Tonkean macaques

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Animals living in groups need to synchronise their activities despite of their different motivations; they have to reach a consensus, especially in the case of departures of collective movement. Recent studies showed that the pre-departure period is critical and suggested the existence of ‘voting’ behaviours. It has been proposed that individuals displaying such behaviours may ‘express their opinion’ but we do not know how the other group members really make the choice about the time or the direction to move. We showed that, in two semi-free ranging groups of Tonkean macaques (*Macaca Tonkeana*), several individuals proposed different directions to move. Before departure, these individuals showed the direction of the future movement by displaying specific behaviours. Subsequently, the whole group took a single direction: it chose the majority. Indeed, they chose as final direction the one for which the more individuals have displayed voting behaviours. Moreover, the individuals for whom the direction was not chosen renounced to their choice, they followed the majority to keep cohesion. Such giving-up often occurred before departure, when the number of individuals displaying voting behaviours was higher in the other direction than in their own; we showed that the decision was already taken by the group before the start of the collective movement. This decision-making is a real ‘shared’ consensus between group members.

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## Gregariousness as a defense strategy in *Pyrrhocoris apterus* (Heteroptera: Pyrrhocoridae)

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Avian predators use mainly visual cues when they search for food, and their prey choice is strongly influenced by warning coloration. Several Central European Heteroptera: Pentatomomorpha share similar red-and-black colour pattern and are regarded as members of a mimetic complex. The firebug (*Pyrrhocoris apterus*) is the most common species of this complex. Although wild caught great tits (*Parus major*, Paridae) avoid adult firebugs, naïve great tits killed them significantly more frequently than other tested species of the complex during the avoidance learning. Consequently, the adult firebug seems to be rather a quasi-Batesian mimic. Provided the aggregative behavior of the firebug amplifies its visual aposematic signal and compensates for the delay between being eaten and the predator sickness, the position of the firebug would be shifted from quasi-Batesian to Müllerian within the complex. We tested this hypothesis with both the aposematic and non-aposematic (brown-painted) form. When offered to tits individually, mortality of the two forms was the same during the avoidance learning. An aggregated presentation accelerated avoidance learning of aposematic firebugs, not of the non-aposematic ones. Owing to gregariousness, mortality of the firebug has been reduced to the same level as that of the other members of the mimetic complex. The study was supported by the Czech Science Foundation (projects 206/07/0507).

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## **Fixed and flexible alternative reproductive tactics coexist in a snail-brooding cichlid**

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Male alternative reproductive tactics (ARTs) usually involve individuals investing in monopolization of fertilizations, and conspecific competitors parasitizing this effort. ARTs may be fixed for life or flexible depending on conditions such as age, relative size or competitor densities. The coexistence of fixed and flexible tactics within one species entails a particular challenge to understand the evolutionary mechanisms generating and stabilizing ARTs. In the cichlid fish *Lamprologus callipterus*, giant bourgeois males build nests of empty shells in which females reproduce. The investment of these males is exploited by opportunistic sneakers adopting a transient and conditional parasitic tactic, and by specialized dwarf males remaining parasitic for life. Here we present data on the genetic and environmental determination of male tactics in this species, on their age at maturity, reproductive lifespan, behavioural effort and reproductive rate. Our estimates suggest that the discrete, genetically determined ARTs of dwarf and giant males render a similar lifetime fitness, whereas the conditional, opportunistic sneaking tactic of differently sized males proves less successful than other spawning tactics. This confirms theoretical expectations derived from formal models of ARTs.

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## Size-assortative mating by prudent habitat choice

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Size-assortative mating is one of the most common reproductive patterns in animals. Proposed mechanisms and functions of size-assortative mating usually involve sexual selection and fitness benefits of mating with similar-sized or larger partners. In the monogamous, biparental African cichlid *Eretmodus cyanostictus* we studied a different mechanism of reproductive size-assortment. A partner removal and release experiment revealed that both sexes accept readily any partner for re-mating independent of its size, but that territory ownership is determined by intra-sexual competition and a size-dependent potential to win fights. In undisturbed pairs we observed that partnerships change frequently. Apparently, size-dependent competitive potential and habitat choice determines where the fish settle. Despite a preference for highly structured habitats, only large pairs moved into territories after experimental improvement of habitat quality, whereas smaller fish occupied territories with experimentally reduced quality. Our results suggest that prudent habitat choice is the mechanism responsible for size-assortative mating in this cichlid. Habitat preference in combination with a strict size-dependent competitive potential and a dynamic mating system results in inevitable size assortment of partners. This ecological mechanism of size-assortative mating is likely to be widespread in territorial species living in saturated habitats.

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**Sensory system biases, learning biases  
and the evolution of sexual signals.**

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Many species possess conspicuous sexual traits or signals. A prime question is how such signals evolve. The most commonly held view is that they arise by sender-receiver co-evolution through selection on signal contents, in which trait evolution either precedes or coincides with the evolution of signal preference. An alternative view, however, is that the preference evolves first and drives subsequent trait evolution. In this view, preference biases in a sexual context are predominantly thought to be a side effect of perceptual sensitivities that are adaptive in another context. Such biases may next be 'exploited' in a sexual context, giving rise to signal evolution. In many species learning processes can affect signal preferences. I address whether such learning processes can give rise to biases that might affect signal preferences. One process that might give rise to such biases is that of 'peak shift'. Peak shift arises whenever two closely related stimuli need to be distinguished and can be seen as skewed generalization. I show that zebra finches that learn to distinguish between closely similar songs can show a peak shifted preference for novel songs. Peak shifted preferences can also arise from the developmental process of sexual imprinting, which is a learning process giving rise to sexual preferences in birds. I will argue that sensory system and learned based biases differ in a number of ways and may affect signal evolution in different ways.

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**Exploitation of host compensatory responses:  
the must of manipulation?**

Thomas Frédéric

Abstract not received



## Trade-offs between disruptive coloration and crypsis: a cross-species comparison

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Detection of an animal on a complex background can be reduced by several possible strategies. If the animal's pattern and coloration resemble those of the background – as in the case of crypsis – then detection of the body surface is difficult, but edge discontinuities may enable detection. On the other hand, disruptive coloration utilises the presence of high-contrast elements to mask the perceptual coherence of the body. However, these high-contrast components may themselves be detected. This suggests that there may be an optimal compromise between these two factors. We investigated this by taking photographs of the bark of mature oak trees in woodland near Bristol, and printing two-tone patterns of the bark onto paper as triangular artificial “moths”. The intensity values of the light and dark tones were selected from different parts of the overall intensity histogram, such that the more common values represented a cryptic concealment strategy, and the more extreme values represented a disruptive strategy. Detection of the artificial moths on oak trees was measured for avian predators by the survival time of mealworm bait affixed to the moths, and for human participants by a search task in which a laser rangefinder was directed at any detected moths, giving measures of mean detection distance and probability. The results for both taxa indicate the presence of an optimal compromise between pattern matching and disruptive coloration.

**When wolves look to humans:  
Domestication and social cognition in domestic dogs.**

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One of the greatest success stories in the history of human-animal social relationships can be found with domestic dogs. Not only were dogs the first species to be domesticated (Nobis, 1979) but they have been specialized into more breed categories than any other animal alive (Svartberg, 2006), making them flexible companions in a variety of niches. Although in recent years much of their success has been attributed to correlated genetic byproducts of domestication (Hare, 2005), including the possible convergent evolution of a human-like social cognition, our research has shown that this explanation cannot by itself account for the sensitivity domestic dogs often demonstrate for human social cues. By comparing the performance of different groups of canids on object choice tasks requiring the use of human given gestural information, we have found that socialized wolves can use human cues without training whereas dogs in some environments cannot use the same information. Furthermore, we show that past differences in testing environment and methods between groups can account for much of the variation reported to exist between species. These findings suggest that rearing environment, socialization, and interaction environment are key aspects in predicting successful human-canine interactions, in both domesticated and non-domesticated species.

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**Virus-generated polymorphism of egg-laying strategy  
in a parasitoid wasp.**

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In natural populations, the pattern and distribution of phenotypes often result from the complex interplay between the genotypes and the environment (either abiotic or biotic). In particular, microparasites are increasingly identified as important agents potentially affecting the expression of host phenotypes. By studying the phenotypic variations of a behavioural component of egg-laying strategy of a parasitoid species, we identified a frequent and inherited virus as a major factor underlying these variations. The virus is responsible for an alteration of the strategy of acceptance of parasitized hosts, which directly benefits the virus by allowing its horizontal transmission. The ecological consequences of the virus presence together with the identification of the factors influencing the intensity of the behavioural manipulation are investigated.

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## **Anthropogenic noise impacts acoustic communication of the intertidal-nesting Lusitanian toadfish**

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Underwater noise pollution derived from shipping is an increasing environmental problem in particular for acoustically communicating species. While efforts have been made to document its negative consequences on marine mammals, the effects on fishes have been poorly investigated. We investigated the implications of noise generated by a ferryboat on sound detectability in the Lusitanian toadfish, *Halobatrachus didactylus* (Batrachoididae), which occurs frequently in human-altered habitats. Ambient and ferry-boat noises as well as toadfish vocalizations were recorded in the Tagus River estuary (Portugal), and their sound pressure levels were determined. Auditory sensitivity was measured under quiet laboratory conditions and under ambient and ship noises, using the auditory evoked potential recording technique. The Lusitanian toadfish showed best hearing at low frequencies between 50 and 200 Hz. Under ambient noise conditions hearing was slightly masked at lower frequencies, whereas in the presence of ship noise, auditory thresholds increased significantly up to 36 dB at the most sensitive frequencies. Comparisons between masked audiograms and sound spectra of the toadfish's mating and agonistic vocalizations showed that ship noise may decrease the ability to perceive conspecific sounds. We provide evidence that fishes' hearing can be masked by ship noise and that acoustic communication might be impaired in coastal environments affected by anthropogenic activities.

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## **Extinction is not the opposite of colonization: lek spatial structure changes during two opposite population dynamic regimes**

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Living in group is associated with many costs and benefits and has been widely studied among animals, especially when individuals cluster as to minimize predation risks or optimize foraging success. But groups also arise during reproduction when individuals cluster to assess sexual partners. A peculiar mating system is the lek, where one sex aggregates and displays on small defended territories as to get copulation from the other. Whether the spatial structure of the lek differs with regard to overall density, and more generally the way lekking species may react under different regimes of population growth has however received very little concern. We present here the results of a 10 years monitoring program on the Little Bustard, a critically endangered species which shows an exploded-lek mating system. The study population underwent a steep decline from 1996 to 2003 (65 to 6 males) but conservation measures undertaken from 2002 allowed it to recover. We used both conventional and more sophisticated spatial analyses to finely describe males' aggregation patterns in relation to density, population growth rate, and landscape structure. We show that when the population declined, males were getting more clustered while each male was occupying a larger territory whereas during the increase, there was no decrease in aggregative behaviour, but males' home range became smaller. We discuss these results in the light of a costs-benefits approach in relation with levels of aggregation.

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## Quorums, consensus and leadership in fish shoals

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Despite the growing interest in collective phenomena such as 'swarm intelligence' and 'wisdom of the crowds', little is known about the mechanisms underlying decision-making in vertebrate animal groups. We examined this field using a combination of experimental and modelling approaches. In our experimental work, we used two different automated approaches to test hypotheses relating to group movement decisions in fish. We found that quorum responses were of key importance to group decision-making and that the accuracy of decision-making increases with group size. In addition, we found that the ability of leaders to successfully initiate movements in a group changes over time as group members gather more information about their environment. Model simulations based on our data show that quorum responses enable fish to improve the accuracy and speed of their decision-making over that of independent decision-makers or those using a weak linear response.

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## **Are the personalities of captive animals relevant to wild conservation?**

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While the phenotypes and personalities of wild animals are the expression of responses to selection, selection on captive animals is largely relaxed. As a result, captive animal populations can exhibit more phenotypic variation than wild populations. The personalities of captive animals can influence wild animal conservation either directly or indirectly. These effects arise from variation in the reasons for keeping animals in captivity. Zoological institutions often maintain animals to educate the public and for potential reintroduction to the wild. These two conservation purposes require fundamentally different responses of animals in various situations. As a result, variant personalities might enjoy more or less success depending upon the conservation need at hand. While personalities that affect conservation directed behavior of people might be best for educational purposes, others may be the best candidates for in situ release programs. In addition, and perhaps more importantly, the cause of high phenotypic variation in captivity, relaxed selection, may be a means of viewing the phenotypic potential of species. Through a glimpse of the phenotypes possible, we may be able to tailor populations comprised of personalities best suited to specific selection regimes and thus directly affect wild conservation.

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## Costly information: Predation risk and social learning in fish

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Privately gathered information is generally accurate but expensive to acquire, while social information is cheap, but can be less reliable. Theory predicts that the use of private information should predominate when the risks associated with doing so are low, but that the use of social information should increase as the costs associated with gathering private information become greater. In experiment 1 we presented minnows (*Phoxinus phoxinus*) with a choice of feeding from a patch that they had previously seen demonstrators feed from and one which they had not. Focal fish were tested alone, and selected between these feeders under different levels of simulated predation risk. We found that they were more likely to enter the demonstrated patch first, had the greatest disparity in time spent in the demonstrated versus the non-demonstrated patch and made the fewest switches between patches when predation risk was high compared to when it was lowest. In experiment 2 we compared public information use between multiple sympatric populations of two sticklebacks (*Gasterosteus aculeatus* and *Pungitius pungitius*) that differed in their armourment and vulnerability to predation. Our data suggests the existence of robust species-level difference in public information use, with no effect of local predation pressure. Our findings suggest that fish can evolve both flexible and rigid social learning strategies in order to balance risk and accuracy when foraging in variable environments.

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## Effects of personality and sex on behavioural patterns and stress coping in human-dog dyads

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Based on similar physiological and social mechanisms in vertebrates we propose that humans are able to maintain truly social relationships with their companion animals. We therefore predict characteristics of vertebrate long-term dyadic relationships in human-animal dyads. We explored these ideas in human-dog dyads. Dyadic behaviours and interactions of 23 dyads (11 male, 12 female owners, aged 23-68, with their intact male dogs, aged 1.5 to 6) were observed and video-taped in different test situations (e.g. mildly threatening of the dog); furthermore saliva samples of owners and dogs were taken. Owners took a NEO-FFI personality test. During the threatening situation, male owners touched their dogs for longer periods of time than did female owners (Mann-Whitney-U:  $n=22$ ,  $Z=-2.664$ ,  $p=0.008$ ) and the more conscientious (FFI-personality axis) the owners, the less the dog barked and growled (Spearman's:  $n=22$ ,  $r_s=-0.474$ ,  $p=0.026$  and  $r_s=-0.471$ ,  $p=0.027$ ). The cortisol levels of owners and their dogs after this threat challenge were positively correlated (Pearson's:  $n=20$ ,  $r=0.495$ ,  $p=0.027$ ). The more the female owners interacted with their dogs during the threat situation, the higher were the dogs' cortisol levels afterwards (Pearson's:  $n=12$ ,  $r=0.601$ ,  $p=0.039$ ). Our results suggest significant contingencies between gender and personality of owner and dog dyadic interactions and stress levels. We acknowledge funding by IEMT Austria.

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## **Going wild: what we can learn from animal movement studies**

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Tracking individual animal movement in the wild is key to understanding animal behavior and decision making. I will show how we used and developed new technologies to study orientational and navigational decisions in aerial animals (birds, bats and insects). Our data show that decision rules and mechanisms may be simpler and more similar across animal taxa than previously anticipated. I will discuss the future of animal tracking studies, particularly with regard to 'MoveBank', a global data repository for animal movement data, and the 'ICARUS initiative', a push towards a global small-animal surveillance system for experimental biologists.

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*Notes*

## **Boldness and behavioural syndromes in bluegill sunfish (*Lepomis macrochirus*)**

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In recent years, evidence for inter-individual variation in “temperament” within animal populations has been accumulating. Temperament is defined as consistency in an individual’s behavioural responses over time and/or across situations. One temperamental trait that has potentially far-reaching implications for behavioural ecology, and may provide insight into the mechanisms by which consistent behavioural correlations arise, is that of boldness. Boldness is defined as the tendency of an individual to take risks and be exploratory in novel contexts. Using the framework of behavioural syndromes, we tested for individual differences in boldness in field-caught juvenile bluegill sunfish (*Lepomis macrochirus*) within and across the contexts of exploratory behaviour, activity, space use, foraging, and anti-predator behaviour. After laboratory testing, individuals were tagged and returned to their lake of origin as part of a mark-recapture study testing for the repeatability of individual differences in boldness and associated fitness correlates. Three months later we were able to recapture 50% of tagged individuals. We found consistent and repeatable individual differences in boldness within and across all behavioural contexts both in our initial experiments and among recaptured individuals. This study provides novel evidence for a boldness syndrome in sunfish as well as important insight into how behavioural types (e.g. shy/bold) may evolve and be maintained in natural populations.

## Strategy emergence from evolutionary simulations of predatory response

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Conclusively linking an evolved behaviour to its underlying selective pressure remains a difficult problem in both complex models and the real world. Group aggregation, a collective form of behaviour exhibited ubiquitously across the natural world is no exception. The preferential formation of groups has been linked to host of stimuli: to feeding efficiency, to social hierarchy advantages, and most prominently, to predation which has number of sub-divisions such as dilution effects (the so called selfish herd), confusion effects and vigilance effects. Recent work has sought to address the issue of model complexity and evolutionary pressure simultaneously with a view to clarifying issues in both. This approach has made use of computational models to simulate predation and foraging challenges on groups of autonomous organisms.

In the work we present we shall concentrate on the effects of predatory behaviour and on understanding the emergence and identification of the strategies that spontaneously merge. This approach helps us to focus on the weaknesses of the underlying model and enables us to suggest possible future avenues for investigation, motivated both by our own work and recent experimental advances, that will improve underlying models.

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*Notes*

## The Ontogeny of Theory of Mind abilities in dogs (*Canis familiaris*)

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“Theory of mind” is the ability to accurately interpret the intentions of another individual. This individual could be a conspecific or, in certain cases, a member of another species – often a commensal. The relationship of domestic dogs (*Canis familiaris*) and their human hosts (*Homo sapiens*) offers many examples of inter-specific theory of mind. Dogs, for example, readily follow human pointing gestures to find hidden food and distinguish between attentive and non-attentive humans when selecting from whom to beg (see Udell & Wynne, 2008, J. Exp. Anal. Behav. 89: 247-261). Though theory of mind is often discussed in mentalistic terms, ultimately it is a form of stimulus control. The behavior (gaze direction, gestures, etc.) of one individual acts as a stimulus controlling the behavior of another individual. Several authors have argued that dogs’ theory of human minds is essentially innate with little ontogenetic component (e.g., Riedel et al., 2008, Anim. Behav., 75: 1003-1014). We will argue that there are at least two major components to the ontogeny of theory of mind abilities in dogs. First, irreversible critical-period learning to accept humans as social companions. Second, associative conditioning to make features of the human body and characteristic human movements into stimuli that control dog behavior. We present a reanalysis of data reported by Riedel et al. (2008) as well as data of our own on the development of dog’s ability to follow human pointing gestures.

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# POSTERS SESSIONS ABSTRACTS

Alphabetical order

Poster 1**Sex differences in eavesdropping in the domestic canary (*Serinus canaria*)**

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Songbirds can extract information from signalling interactions ; this is known as eavesdropping. Most studies on eavesdropping focus on the utilisation of the gathered information. For instance males respond differently to winners and losers of previous interactions, and females use the gathered information to direct their sexual behaviour. However few studies have examined eavesdroppers' behaviour during the acquisition of the information. Here we compare the behaviour of male and female canaries (*Serinus canaria*) during the broadcast of a singing interaction in which one song overlaps the other; this type of interaction provides relative information to eavesdroppers. We noted the latency of the first call and the amount of calls emitted during the broadcast. Females emitted their first call significantly more quickly than males and emitted significantly more calls than males during the broadcast. By calling, eavesdropping females could attract males' attention and we therefore suggest that females could also encourage aggressive singing interactions. On the contrary, eavesdropping males could be inhibited by aggressive singing interactions and avoid to signalling their presence to potential rivals.

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Poster 2**Neophobia and risk-taking of urban and rural house sparrows (*Passer domesticus*)**

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Increasing number and area of cities is creating new habitats for wild animals, yet it remains largely unknown how the challenges of urban habitats such as altered food supply and predation pressure affect the behavior of urban-dwelling animals. In this study we compared the behavioral responses to novelty and predation risk of urban and rural house sparrows. We caught 58 non-breeding wild house sparrows from 2 urban (inner town) and 2 rural (farm) habitats, and maintained them in outdoor aviaries before behavioral tests. During the winter months, each bird took part in a 5-day series of tests conducted in individual cages. To investigate neophobia, we measured the latency to approach the feeder with a novel object next to, or novel food in it, during the first feeding in the morning. To investigate risk-taking behavior, we measured the latency to approach the feeder after a 5-min exposure to a mounted sparrowhawk at the start of first feeding in the morning. We found no difference in neophobia either to novel objects or to novel food between urban and rural birds. However, sparrows from urban habitats approached their feeder later upon predation risk than sparrows from rural habitats. Furthermore, urban birds maintained smaller body mass during the study than rural birds. These results suggest greater predation risk (perhaps by sparrowhawks) for house sparrows living in urban than in rural habitats, which might select for more wary behavior in urban birds.

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Poster 3**Social hierarchy and feeding success in wild *Callithrix jacchus* primates, callithrichidae**

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Resource competition is among the costs of group living. Scramble competition is an indirect type of competition, mainly associated with factors like group size and distribution of resources. Contest competition occurs when individuals compete directly for resources. Dominance hierarchy can be found in species that exhibit this type of competition, resulting in differences on feeding and reproductive benefits for each member of the group. In these cases, aggressive and submissive behaviours are expected as a way to signalling social status. This study investigated the effects of social hierarchy in *Callithrix jacchus* food ingestion. Data recording was from Sep/2006 to Mar/2007, 8 days/mo, at “Floresta Nacional de Açu” – ICMBiod, an area of the north-eastern caatinga in Brazil. Observations were from 05:00 am until the last animal got into the sleeping tree. Analyses of aggressive interactions, behavioural profile and diet, indicate advantages for dominant animals in the group. Dominant individuals had higher intake of animal matter than subordinates. The last ones consumed fruits, exudates and, eventually, explored items that were not common in the diet. We suggest that dominance hierarchy provides the reproductive female priority in access to food resources, important to make up for costs required for maintaining species’ high reproductive rates; also, that reproductive male foraging efficiency is lowered due to participation in food transfer to youngsters in the group.

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Poster 4**Food transfer in wild *Callithrix jacchus* infants and juveniles**

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Food transfer has been registered as a kind of postnatal investment, especially effective if foraging strategies and diets are complex. In Callitrichidae, food transfer has been shown to be a fundamental component of cooperative care. This study compared food transfer to wild infant and juvenile *Callithrix jacchus*, in 2 groups, one in caatinga and the other in an urban area in north-eastern Brazil. Three infant and 4 juvenile sets were observed. All food transfers were registered using continuous sampling once a week. Even beginning in the 2nd month of infants' life, most transfers occurred between 3rd and 5th mo, especially insects, with great tolerance by the provider. Active transfers were only registered in caatinga. Adult males were the main providers. Along juvenile phase transfers dropped and youngsters started foraging with their group. For all sets, unsuccessful food transfer was significantly higher then. Results demonstrate how precocious food transfer is to encourage nutritional independence. Most group members participate in transfers but in a variable pattern. Preferential items were animal preys, with high nutritional value and requiring skill to be captured. Tolerance by caretakers is gradually lowered, especially to juveniles. Active transfer by donor in the caatinga, not common in *C. jacchus*, indicates the importance of the ecological factors as much as young age and social conditions.

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Poster 5**Group structure, nest size and reproductive success in the cooperatively breeding cichlid  
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Group size, defined as total number of breeders plus helpers, has been shown to positively correlate with the number of young raised by breeding groups in many cooperative breeding animals. However, little is known whether group size affects reproductive success in fish. Recent studies on group-living fish have also shown that group size is significantly related to body size of group members. A field study was conducted to examine the relationship among group size, body size of group members and nest size in the cooperatively breeding cichlid *Julidochromis ornatus*, in which unrelated helpers frequently participate in reproduction. Breeding groups use rock crevices for breeding nests, providing shelter sites for group members and offspring from predators. The results showed that group size was significantly related to body size of group members rather than nest size; and larger breeders had larger helpers. We also examined what factors (group size, nest size and body size of female breeders) affect the number of offspring guarded by group members. It was found that group size was the only factor that increased the number of offspring per group. We conclude that breeding groups of *J. ornatus* have size hierarchical societies that relate to group size, and unrelated helpers increase the group reproductive success.

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Poster 6**The interaction between a forager's cognitive abilities and prey spatial distribution on the intake rate: a simulation model**

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Foragers are expected to choose their path according to their knowledge of prey spatial distribution, when such knowledge is acquirable. Classical optimal foraging theory considers patch use and prey consumption in spatially implicit domains (a series of visited patches) but not the choice of a foraging path. When the spatial variation in prey density is slight (i.e. no well-delineated patches) studying foraging requires relating predators' paths to prey distribution. Although in this context cognitive variables such as the perception range and the extent of spatial memory are known to determine space use of foragers, their effects on the long-term intake remain largely unknown.

Using a spatially explicit model of prey distribution and a modified correlated random walk for forager movement, we studied how the cognitive abilities of a central place forager could influence its intake rate. We found that the intake rate increased and eventually saturated with the perception range, regardless of prey spatial distribution. In contrast, the effect of spatial memory on intake rate was modulated by the aggregation of prey spatial distribution. Nevertheless, it was not more beneficial to have simultaneously a highly efficient memory and a wide perception range. These results suggest that predators may have specialized into one of these strategies (i.e. long-term memory vs. large perception of prey distribution) depending on the level of spatial aggregation of food resources.

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Poster 7**Microsatellite analysis of male relativeness within leks of Golden-collared manakins**Barske Julia<sup>1</sup>, Ciofi Claudio<sup>1</sup>, Fusani Leonida<sup>2</sup><sup>1</sup>Department of Evolutionary Biology, University of Florence<sup>2</sup>Department of Biology and Evolution, University of Ferrara

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The Golden collared manakin (*Manacus vitellinus*) is a Neotropical passerine with a lek mating system. During a 7-month breeding season, male manakins aggregate in leks and each male clears a small 'court' on the forest floor where he performs his courtship displays. The combined action of male-male competition and female choice influences individual reproductive success. However, the skewed male mating success typical of lek species and also described in *Manacus* opens to the question of why do some males aggregate in leks when their chances of obtaining matings are so low. It has been suggested that kin selection is one of the factors contributing to the evolution of lekking behavior: If lek size is positively correlated to the number of matings of the most successful males, individuals genetically related to these males might increase their inclusive-fitness by joining the lek. We investigated genetic relationships between males in leks of Golden-collared manakin in relation to their position within the lek, display activity, and mating success. We recorded the behaviour of 37 males in 7 different leks during the courtship season and assess kinship using 8 polymorphic microsatellites loci.

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Poster 8**Inadvertent social information in plant-pollinator interactions**Baude Mathilde<sup>1</sup>, Dajoz Isabelle<sup>1</sup>, Danchin Etienne<sup>2</sup><sup>1</sup>BIOEMCO UMR7618, 46 rue d'Ulm, 75230 Paris Cedex05, France<sup>2</sup>EDB UMR5174, 118 route de Narbonne, 31062 Toulouse Cedex09, France

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Pollinators are confronted to spatial heterogeneity and diversity in floral resources. Acquiring information about their environment thus allows them to optimally exploit floral resources, hence strongly affecting their fitness. Here we focus on the use of inadvertent social information (or ISI), that can be extracted from the observation of the behaviour of conspecifics, by pollinators in flower decision making. The aim of our study is to investigate links between plant community and ISI use by pollinators.

First, we experimentally tested the effects of ISI use (without or with an experienced demonstrator) in relation to spatial flower distribution (random or patchy) in foraging *Bombus terrestris*. Experiments were performed with rewarding and non-rewarding artificial inflorescences slightly differing in colour. Our results show that the presence of demonstrators improved the performance of naive bees when flowers were patchily distributed. This suggests that naive bees extract ISI, probably in the form of social attraction at the patch scale. On the other hand, analyses of switches performed by naive bees between flowers underline potential implications of ISI use for the efficiency of plant community pollination. Lastly, we deal with the influence of the diversity of the flower community in ISI use by pollinators. By coupling behavioural and community ecology, this study offers promising perspectives for cognitive ecology studies in plant-pollinator interactions.

Poster 9**Support problem tasks in Kea (*Nestor notabilis*)**Bayern Alice M.I.<sup>1</sup>, Huber Ludwig<sup>1</sup>, Gajdon Gyula K.<sup>1 2</sup><sup>1</sup>University of Vienna, Department for Neurobiology and Cognition Research, Althanstrasse 14, A-1090 Vienna, Austria<sup>2</sup>Konrad Lorenz Institute for Ethology, Savoyenstrasse 1a, A-1160 Vienna, Austria

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Patterned string pulling tasks were conducted in birds to show high cognitive problem solving skills. In these tasks, the birds have to pull a string suspended from a perch in order to get access a reward at the end of the string. The Kea, a mountain parrot of New Zealand, performs very well in such tasks (Werdenich and Huber: Anim. Behav. 71, 855-63). The horizontal analogue of string pulling, called the support problem, has mainly been studied in primates. In this task, the rewards which are out of the subject's direct reach can be retrieved by pulling one of two boards on the ground depending on the spatial relation between reward and board. Here, we present data on support problem tasks offered to kea in order to achieve a more comprehensive comparison between birds and primates. A series of support problem tasks were conducted with varying forms of the boards' end and spatial relations between boards and rewards as well as boards and subject. In addition, developmental aspects are considered in regard to different sensorimotor tasks as well.

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Poster 10**How birds evaluate the risk of predation in winter feeder experiments –  
the significance of the movement**

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The categorization of predators in winter feeder experiments is an interesting indicator, how birds evaluate the dangerousness of different predators. In the winter, the birds often deal with a dilemma between the gain of food and the fear from a predator. I examined the influence of presence of different predators and artificial objects and their movement during winter feeder experiments. Surveyed species were Great Tit (*Parus major*), Blue Tit (*Parus caeruleus*), Marsh Tit (*Parus palustris*), Willow Tit (*Parus montanus*), Greenfinch (*Carduelis chloris*) and Siskin (*Carduelis spinus*). Tested objects were Sparrow Hawk (*Accipiter nisus*), Stone Marten (*Martes foina*), domestic Pigeon (*Columba livia* f. domestica) and plushy toy.

A Sparrow Hawk and a Stone Marten appeared to be the most dangerous for birds, they sinked the number of arrival on the feeder at the minimum. Domestic Pigeon appeared to be less dangerous. The plushy toy induced the least attention. There was an inceptive hypothesis for the significance of the movement that it should sink the number of arrival on the feeder compared to the static model. This presumption wasn't confirmed. According to my results the movement doesn't have any influence on the number of arrival on the feeder. The type of model is the only crucial for it.

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Poster 11**Use of public information in the search for food in the domestic canary (*Serinus canaria*)**

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Social life allows animals to use information provided, voluntarily or not, by conspecifics, particularly to locate predators or food. Recent studies show that animals can take into account the performances of their peers and use this information to adjust their survival and reproduction strategies. The use of this social information in birds in their foraging activities is a growing research subject. We hypothesized that domestic canaries would be able to use information provided by conspecifics in a foraging context. In this study, we tested whether male canaries could use information provided by a conspecific in order to find dissimulated food in an object choice task. A demonstrator was trained to go and feed in one feeder among five opaque feeders. After witnessing five demonstrations, a subject was allowed to search in turn for the food. Subjects found the feeder containing food more often and more quickly than control birds that had not seen the demonstrator. Control birds turned to another source of information: their own sampling. We will expand those results by studying the use of social information during foraging in urban pigeons. This fieldwork will allow a comparison between two different species, one tested in laboratory conditions and the other in more naturalistic conditions.

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Poster 12**Priming effect and pre-exposure aggression in Siamese fighting fish**

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Interactions and communication between individuals occur in a complex social environment in which senders and receivers are able to adjust their behaviour according to the context. Watching fights between others acts on a bystander's motivation to engage in a fight and may make it behave more aggressively during subsequent disputes. This phenomenon is known as aggressive priming. The aim of our study was to investigate if this priming response follows a step function, i.e. appears only above a threshold level of aggression witnessed by a bystander. We found that bystanders behaved more aggressively in subsequent interactions when pre-exposed to an aggressive conspecific that was engaged in a fight whatever the level of aggression this fight reached. However, bystanders' behaviour after pre-exposure was not correlated to the previously witnessed level of aggressiveness. These results suggest that individuals alter their behaviour in an aggressive social environment and indicate that priming effect follows a step function where aggression is triggered by an aggressive context. We discuss our results and the effect of pre-exposure on agonistic interactions in a communication network perspective.

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Poster 13**Breeding density, maternal effects and reproductive success in house sparrows**

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Social competition affects the rate or the intensity of intraspecific interactions. Despite such interactions individuals of many species still prefer to live in social circumstances. This raises the possibility that the costs of social competition are traded against the benefits of sociality. If individuals of different phenotypic quality differ in their ability to cope with stressful social situations, we might expect them to be non-randomly distributed across social environments. This potential variation in individual or environmental quality with colony site might be reflected in differences in reproductive success. However, whether density itself could functionally influence the behaviour and breeding success of birds is not known.

In this experiment using nest box arrangements in aviaries, we tested the effects of breeding density in house sparrows *Passer domesticus*. We found that a lower proportion of birds initiated a breeding attempt in the lower density situation and that the time taken to initiate nest building and then laying was lower in the medium and high density situation. However, there was no difference in clutch size across breeding densities. In addition, maternal effects through investment of hormones and antioxidants to eggs differed according to breeding density. This therefore suggests that colony size in itself may influence various aspects of breeding behaviour, independently of individual quality and environmental effects.

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Poster 14**The boldness and shyness of the hermit crab *Pagurus bernhardus*:  
Animal personality or behavioural plasticity?**

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It has been recognized by behavioural ecologists, that behaviour differs between individuals and that such differences can have significant consequences on individual fitness. We studied boldness-shyness in the hermit crab *Pagurus bernhardus*. A total of 120 crabs were collected at three different sites of the South-West of England (Mountbatten, Hannafore, and Bantham) and we measured the duration of a startle response in the field and under different situations in the laboratory.

By imposing on the crabs a range of shell sizes it was shown that the quality of the shell has some influence on the boldness of the crab. Although the crabs showed behavioural plasticity, however, there was a stronger pattern of relative consistency in individual behaviour. Different levels of boldness were found between geographical areas, especially with the Mountbatten crabs which were shyer than those from Bantham and Hannafore, and the strength of behavioural consistency varied between locations. Furthermore, the Mountbatten crabs adapted quickly to the new situation in the laboratory by behaving in a bolder way than in the field. Regardless of the causes of differences between sites, the clear pattern of behavioural consistency indicates the presence of animal personalities in hermit crabs.

Key words: personality trait, consistency, boldness-shyness, behaviour plasticity, behaviour consistency, adaptive individual differences, life history strategies.

Poster 15**The effect of environmental change in seahorse *Hippocampus kuda* behaviour**

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Evidence from aquaria suggests that captive fish on public display often exhibit several stress-related symptoms associated with variations in water quality, poor nutrition etc. My research tried to ascertain whether being on public display has any noticeable effect upon seahorse behaviour as well as considering the effects of environmental change. Ten captive seahorses (*Hippocampus kuda*) were studied over a period of two months at the Marine National Aquarium, Plymouth (UK). They were divided into two groups: four in a control tank and the remaining six in an experimental tank. Both groups were kept out of view for the first month in order to allow them to acclimatise to their new surroundings but in the second month the seahorses from the experimental tank were put on a public display to test whether observational pressure had any effect upon their behaviour. Five elements of normal seahorse behaviour were recorded; courtship, tail-grasping between partners, dance patterns leading to seduction and competition. Also, new behaviours had been observed such as segregation behaviour between males and females, head-lowering associated with rejection, female interferences between the dominant couple etc. The results showed that seahorses respond well to their new environment and the observations of their behavioural traits seem to indicate a positive response to public exposure.

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Poster 16**Light intensity and agonistic interactions in three cichlid species**

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Animals show behavioural changes due to variations of environmental physical factors. Luminosity probably affects aggressive behavior in fish because this abiotic factor regulates many activities. Thus, we compared the effect of light intensity on agonistic behaviour of juvenile cichlids *Geophagus surinamensis*, *Oreochromis niloticus* and *Pterophyllum scalare* under two light intensities: minor-  $253.56 \pm 58.14$  lx and major-  $1446.53 \pm 640.68$  lx (n=10 / species). Fish were isolated in 36 L-aquaria for 96 h and paired (resident-intruder) for enough time to hierarchy settlement. Agonistic interaction was recorded in this period. Major light intensity increased latency for fighting in *G. surinamensis* and *O. niloticus*, but did not affect *P. scalare*. Major light intensity reduced circling, nipping, chase and total fight frequency in *O. niloticus*; increased frontal display and mouth fight in *P. scalare* and did not affect agonistic interactions in *G. surinamensis*. In the 2 light condition, the aggressiveness level in *O. niloticus* is higher than *G. surinamensis* and *P. scalare*. We concluded rising light intensity affects agonistic interaction in different way in the three fish species, and mechanism underlying this data could be related to specific agonistic profile.

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Poster 17**Anti-predatory behaviour of Red legged partridge to terrestrial and aerial predator**

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In many animals from different taxa predator-specific antipredatory behaviours were observed. In some galliformes responses associated to aerial or ground predators clearly differ. Our study aimed to highlight differences in anti-predatory responses to terrestrial and aerial predators in the Red legged partridge (*Alectoris rufa*), taking into account for sexual differences. In detail, we analysed quantitatively behavioural and acoustic responses to fox and hawk moving dummies presented in captivity. To simulate the aerial predator, we used the silhouette of a raptor; as the terrestrial predator, we used a stuffed red fox. Each session-test consisted of dummies presentations in which we measured group vocalisations and individual behaviours. We observed different responses in relation to predators in vigilance, immobility, escape. Sex significantly influenced escape and immobility in response to terrestrial predators. Moreover, non reaction to both predators was significantly influenced by. The rate of vocalisations stimulated by the terrestrial predator was significantly higher than those stimulated by the aerial one, and were characterized by significantly higher frequencies

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Poster 18**A theoretical study of alternative female mating strategies**

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Alternative mating strategies are increasingly recognized as being common in many species. Mating systems need to be described at the individual level to highlight the coexistence of multiple mating strategies in males and/or females. Although alternative female mating strategies have been less studied than male ones, they may also be frequent. For example, both monoandrous and polyandrous females of *Lacerta vivipara* are observed simultaneously. Multiple mating by females can result in several known costs on female fitness (e.g. sexual conflict over the occurrence of mating), but it also exists benefits to polyandry (e.g. enhancement of offspring's quality). Thus different cost-benefit balances may allow the coexistence of alternative female mating behaviours. The aim of this study is to unravel the important factors leading to the coexistence of single and multiply-mated females in the same population. The role of external factors (density, sex-ratio, variance in males' quality) will be explored. We will also investigate the impact of modelling decisions (e.g. calculation of the mating costs and benefits). Then we will focus on the evolution of female mate choice, i.e. the evolution of their threshold of mating acceptance. In particular, we will test when different behavioural decisions (females with different thresholds) are necessary to obtain the pattern of coexistence of monoandry and polyandry. This analysis will be conducted with an evolutionary individual based model.

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Poster 19**Corsican Argentine ant invasion: Evidence for local resistance.**Blight Olivier<sup>1</sup>, Renucci Marielle<sup>2</sup>, Tirard Alain<sup>2</sup>, Orgeas Jérôme<sup>1</sup>, Provost Erick<sup>2</sup><sup>1</sup>Aix-Marseille Université (Paul Cezanne) IMEP (UMR/CNRS/IRD) Europôle méditerranéen de l'Arbois BP80,  
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The Argentine ant is a highly invasive species that has successfully spread from its native range in South America across much of zones of the globe. However, in some cases it seems that the Argentine ant is slow down in its spread. It is the case of Corsica, a French mediterranean island which is less infested than the continent. A possible explanation of this phenomenon is the presence of a widespread, dominant native ant species, *Tapinoma simrothi*. We conducted in the laboratory four behavioral assays to assess whether Argentine ants were able to survive and compete for resources and habitat with *T. simrothi*: (i) worker dyad interactions, (ii) symmetrical group interactions, (iii) intruder introductions into an established resident colony and, (iv) a competition assay for food and nesting space. Our results demonstrate a great competition between the two species, the winner changed following the behavioral assay. None species dominates the other in the success fighting in both dyad interactions and symmetrical group interaction despite a cooperation between Argentine ant workers. Results of the resource competition test indicate that *T. simrothi* numerically dominates food and aggressively displaces Argentine ant from baits and nesting sites. These results suggest that *T. simrothi* may reduce the spread of Argentine ants, and pinpoint the potential resistance of native Corsican ants against Argentine ant.

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Poster 20**Long-term impacts of an early olfactory deprivation**

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Among mammals, olfactory cues play an important role in the development of numerous behaviours. In particular in rodents, the olfactory channel is the most important sensorial avenue for a number of functions including conspecific recognition, sexual and maternal behaviour, feeding behaviour... However, little is known on the physiological and behavioural long-term effects of an early olfactory deprivation. We therefore induced on young rats (*Rattus norvegicus*) a bilateral nasal obstruction (NO) from post-natal day 8 to day 14. At 3 months old, we then compared physiological parameters in untreated, sham and NO groups (morphological parameters, corticosterone plasma levels, immunologic measurements) and anxiety-related behaviours (plus-maze and openfield tests). First results show that an early and reversible bilateral nasal obstruction induces a significant decrease in olfactory bulb development, measured in adulthood. Moreover, it seems to induce long term effects on lymphoid system (thymocytes and splenocytes in NO groups showing less responsiveness to mitogens) and anxiety behaviours (NO individuals appearing to be more active). Similarly to recent studies focusing on long-term impacts of postnatal stressors, this preliminary work enhances the importance of early olfactory experiences in the physiological and behavioural development of individuals.

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*Note*

Poster 21**The predatory behaviour of *Podarcis sicula* (Reptilia: Lacertidae) tested towards  
aposematic and non-aposematic preys.**

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Dietary behaviour of *Podarcis sicula* and the effects of prey chemical repellents were tested using four species of Carabid beetles as prey models. The aim of the study carried out in laboratory conditions, was to assess (i) the ability of *P. sicula* to recognize insect preys provided with chemical repellents and aposematic colorations, and (ii) the importance of chemical signals used by the prey model as antipredatory strategy. Preys used were *Brachinus sclopeta* and *Anchomenus dorsalis* (aposematic species) and *Amara anthobia* and *A. Aenea* (non-aposematic species). Aposematic species are characterized by conspicuous color pattern and by production of chemical repellents, while non-aposematic ones do not. *Amara anthobia* and *A. aenea* were attacked with high frequency by *P. sicula*, *Brachinus sclopeta* and *Anchomenus dorsalis* with low frequency. Non-aposematic species were preyed more often than the aposematic ones. *Brachinus sclopeta* was preyed after low latency, while *Amara anthobia* and *A. aenea* after long latency. Non-aposematic species were captured and eaten without difficulty, while when *B. sclopeta* or *A. dorsalis* were captured, lizards always tossed their head and then rub the snout on the soil, probably because of the unpalatability of aposematic preys.

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Poster 22**Lateralization in the predatory behaviour of the lizard *Podarcis muralis***

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Ectotherms have been demonstrated being lateralized as well as endotherms. This specialization is particularly evident in some species in a bias using the eyes, having a preference in using a particular eye to observe specific kinds of stimuli, processing them with the contralateral hemisphere. Several ectotherms are favorite in this from having a lateral position of the eyes, making them able to carry out more tasks simultaneously, controlled by different eyes and hemispheres. Predatory responses seem mediated by the right-eye/left-hemisphere. As there are no strong evidences of this in lizards, we analysed if males of *Podarcis muralis* in a laboratory predatory context are lateralized when looking at prey and if this task is right-eye/left-hemisphere mediated. Using a T-maze, we recorded what direction they chose to reach a familiar prey observed at the left or at the right side of the longitudinal body axis. With concern to this lizards were lateralized ( $P < 0.05$ ). The preferential direction to reach the prey is the right for the majority (4 of 5) of lizards having a preference, indicating even a tendency of laterality at population level. In addition, lizards maintained the head longer to the same direction they later chose to catch the prey ( $P < 0.001$ ). Our study demonstrates how males of *Podarcis muralis* are visually lateralized to capture prey. This is another support to the hypothesis of common ancestral derivation of vertebrate lateralization.

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Poster 24**Egg investment is influenced by male colouration in the ostrich**Bonato Maud<sup>1</sup>, Evans Matthew R.<sup>2</sup>, Cherry Michael I.<sup>1</sup> 3<sup>1</sup>Department of Botany and Zoology, University of Stellenbosch, Matieland, South Africa<sup>2</sup>Centre for Ecology and Conservation, School of Biosciences, University of Exeter, Cornwall Campus, Penryn, Cornwall, UK

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The differential allocation hypothesis predicts that females mated to attractive males invest more in offspring than those mated to less attractive ones. To date, there has been no evidence that female ostriches discriminate between males as potential mates, but the degree of dimorphism in this promiscuous species and the variation in chick size within clutches suggest that differential maternal investment is highly likely to occur. We investigated the relationship between egg mass and colouration (measured using UV-visible spectrophotometry) of feathers, bill, neck and legs of 15 male ostriches (*Struthio camelus*), maintained in a breeding flock. Eggs were collected and weighed on a daily basis, and parentage analysis was performed using microsatellite markers. We found that the combination of the colour of the neck, white and black feathers and the brightness of black feathers predicted egg mass. Females laid larger eggs for males with higher principal component values for the colour of their neck and white feathers; and with lower values for the brightness and colour of their black feathers. Reflectance spectra for these traits showed two peak reflectance values at 500.5nm and 540.5 nm, in the “green” area of the spectrum. All these traits are exposed during the male courtship display, so we suggest that these visual cues influence the degree of maternal investment in eggs.

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*Notes*

Poster 24**How mice are socially organised in standard vs enriched environment?  
Does it influence their cognitive performances?**

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Although all mice of a same bench are considered to behave equally in psychopharmacological studies, it is far from true from an ethological point of view. Non-related male mice housed in small groups, in standard conditions, hardly bear themselves. In this impoverished environment, a social organization, with only one dominant mouse and several subordinates, is frequently observed. However, very little is known about hierarchy in mice reared in an enriched environment (large groups in environmentally complex cages). The aim of our study is to assess correlation between hierarchical rank, cognitive performances and emotional status in mice, regarding to their housing environment (standard or enriched).

Thirteen male NMRI mice were randomly assigned to standard or enriched housing at weaning. During 3 months, hierarchical organisation and its stability is assessed through several protocols: (i) non-disturbed behaviour in the home cage (ii) drinking behaviour after 24-h water deprivation (dyads), (iii) behaviour towards an intruder (dyads), (iv) behaviour after removing and replacing an individual in its home cage. Thereafter, each animal is tested with protocols classically used in psychopharmacological studies: activity, passive avoidance, spontaneous alternation, spatial reference memory...

Results will address the role of the environment on social organisation in mice, and the influence of rearing conditions in learning, memory and stress-related behaviour.

Poster 25**Mate choice and reproductive success in feral pigeons:  
is plumage polymorphism decisive for reproduction?**

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Last 20 years, evolutionary ecology has given much attention to the plumage polymorphism (more than one colour genetically inherited variants) and its maintenance. In the feral pigeon *Columba livia*, the currently observed plumage polymorphism is mainly due to previous artificial selection of domestic pigeons. An exciting question is how this original polymorphism is still present? One possibility goes through mate choice. Previous studies on feral pigeons, mainly based on behavioural observations, revealed a dissimilar mating or a morph preferably chosen whatever morph of its partner. As a part of a general research project on the “urban pigeon”, our survey relies on genetic tools to study this question.

We used microsatellite markers to determine the parental relationships in a pigeon breeding population (307 individuals in general, 89 breeders and 121 juveniles) from April 2006 to August 2007. We examined the plumage polymorphism of reproductive population, and correlated polymorphism with mate choice and reproductive success.

- (1) Polymorphism in reproductive individuals was similar to that of the total population studied.
- (2) We did not detect any assortative mating according to the plumage polymorphism.
- (3) We found no differences in reproductive success between morph. The fact that we did not find any effect on morph on reproduction may be due to the relatively low number of individuals we studied; alternatively, this effect can be masked by other environmental conditions.

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*Notes*



Poster 26**Comparing the strength of behavioural plasticity and consistency across situations:  
animal personalities in the hermit crab *Pagurus bernhardus***

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Many phenotypic traits show plasticity but behaviour is often considered the ‘most plastic’ aspect of phenotype as it is likely to show the quickest response to temporal changes in conditions or ‘situation’. However, it has also been noted that constraints on sensory acuity, cognitive structure and physiological capacities place limits on behavioural plasticity. Such limits to plasticity may generate consistent differences in behaviour between individuals from the same population. It has recently been suggested that these consistent differences in individual behaviour may be adaptive and the term ‘animal personalities’ has been used to describe them. In many cases, however, a degree of both behavioural plasticity and relative consistency is probable. To understand the possible functions of animal personalities, it is necessary to determine the relative strength of each tendency and this may be achieved by comparison of statistical effect sizes for tests of difference and concordance. Here, we describe a new statistical framework for making such comparisons and investigate cross-situational plasticity and consistency in the duration of startle responses in the European hermit crab *Pagurus bernhardus*, in the field and the laboratory. The effect sizes of tests for behavioural consistency were greater than for tests of behavioural plasticity, indicating for the first time the presence of animal personalities in a crustacean model.

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Poster 27**Helper effects in cooperatively breeding chestnut-crowned babblers**Browning Lucy E.<sup>1</sup>, Russell Andrew F.<sup>2</sup><sup>1</sup>University of Cambridge<sup>2</sup>University of Sheffield

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Cooperative breeding systems, wherein ‘helpers’ raise the young of others, appear to contradict the basic tenet of evolutionary theory, which predicts that individuals should behave selfishly. In order to understand the selective forces acting on helper investment it is necessary to quantify the potential direct and indirect fitness benefits that may be accrued by helping. Kin selection is often invoked to interpret variation in helping behaviour. Implicit in this approach is the assumption that helpers increase their relatives’ production of offspring. While some studies have found that helpers enhance the current and future reproductive success of breeders, others have failed to find any evidence of helper effects. Moreover, establishing a causal relationship between helper number and production of young can be difficult due the confounding effects of parental and/or territory quality. We used an empirical approach to control for potentially confounding variables while investigating the influence of helper number on current reproductive success in a cooperatively breeding bird, the chestnut-crowned babbler.

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*Notes*

Poster 28**Social, not Public Information Use in Guppies**Bruce Matthew J.<sup>1</sup>, Toelch Ulf<sup>2</sup>, Reader Simon M.<sup>1</sup><sup>1</sup>Behavioural Biology and Helmholtz Institute, Utrecht University, The Netherlands <sup>2</sup>Department of Innovation and Environmental Sciences, Utrecht University, The Netherlands

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We investigated the abilities of guppies, *Poecilia reticulata*, to learn the location and quality of a food resource by observing the behaviour of others. A first experiment investigated social information use. Observer guppies saw feeding activity at one of two differently coloured feeders: they could see one demonstrator make feeding pecks to this feeder while the other demonstrator was simply nearby the other feeder. The apparatus was designed so that food or food consumption could not be observed. Observers later preferred a feeder of the same colour and/or in the same location as the feeder where they had previously observed feeding activity. A second experiment investigated public information use. Observer fish saw two demonstrators, one pecking at a rich (high pecking rate) and one at a poor (low pecking rate) feeder. Observers showed no significant preference for the rich feeder over the poor. Thus guppies failed to use public information in this feeder choice, although Experiment 1 demonstrates that they are capable of using social information to locate a rewarded feeder. We repeated the first experiment by replacing domesticated observers with feral guppies. This population of feral guppies showed no significant tendency to prefer the demonstrated feeder, raising the possibility that strains of guppies may differ in their ability or propensity to use social information.

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*Notes*

Poster 29**Impact of cattle grazing on density, habitat use and life-histories in rodents**Bueno Celia<sup>1</sup>, Hartog Linda<sup>2</sup>, Ruckstuhl Kathreen<sup>3</sup>, Neuhaus Peter<sup>1</sup><sup>1</sup>University of Neuchâtel<sup>2</sup>Vrije Universiteit Amsterdam<sup>3</sup>University of Calgary

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Cattle grazing on public land is a common practice in many countries. As grazing areas are often overexploited, cattle is expected to have a strong impact on the environment. In this study, we experimentally evaluated the impact of cattle grazing on the demography and behavior of two small rodent species (Deer mouse *Peromyscus maniculatus* and Meadow vole *Microtus pennsylvanicus*). The field work took place at the Sheep River provincial park, Alberta (CA), where cattle comes every year from mid June till early to mid October. Twelve heavily grazed locations were selected for the experimental setup. Each one consists in two plots measuring 35x35 meters and being a minimum of 30 meters apart. One of the plots remained open and was considered as the control, while the other was fenced with barbed-wire to avoid cattle grazing. The live-trapping sessions were conducted on both treatment plots simultaneously for a given location and repeated each two weeks. A total of nine trapping sessions per location were conducted during the whole season. The results show that grazing seems to have an impact on density, survival and habitat use of the two studied species, each one reacting in a different way.

Poster 30**Wild rooks discriminate subtle changes in humans' attention state**Bugnyar Thomas<sup>1</sup>, Westphal Gesche<sup>2</sup>, Fitch Tecumseh<sup>2</sup><sup>1</sup>University of Vienna, Konrad-Lorenz-Forschungsstelle<sup>2</sup>University of St Andrews, School of Psychology

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Social life allows exploiting information provided by others. One source of information is in the direction of the others' visual behaviour: Orientation of the head and the visibility of eyes may serve as a predictor for the others' attentiveness towards particular resources. We here investigated the responsiveness of wild rooks to humans' attention state. We tested young (< 1 year) and adult birds (> 1 year) from a colony near St Andrews, UK, that regularly feed on human leftovers. We confronted individual birds with food close to a human experimenter (E) who looked towards the food, with eyes open or closed, or away from the food, with head oriented upwards or turned around by 90°. We predicted that birds should be quicker and more successful in getting food (i) when E faced away than towards the food and (ii) when E's eyes were closed than open. Rooks were quickest in snatching food when E turned around. Moreover, young rooks hesitated longer from taking the food when E was facing it with eyes open than with eyes closed. However, adult rooks were more hampered by the eyes-closed than the eyes-open condition, potentially because the former challenged their expectation ('an individual facing towards food has its eyes visibly directed at the food'). These findings indicate that wild rooks foraging on leftovers are capable of differentiating subtle differences in humans' visual behaviour and that age and/or experience may affect their interpretation of others' attention.

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*Notes*

Poster 31**The interaction of parental age and oxidative-stress resistance on offspring memory**

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While evidence accumulates that higher parental age detrimentally effects offspring cognitive function, and parental age at birth continues an upward 25 year trend, little progress has been made in describing the proximate or ultimate mechanisms driving this relationship. We are investigating the effects of parental age and resistance to oxidative stress (a major factor in ageing) on short-term memory and two forms of consolidated memory, long-term and anesthesia-resistant memory, in *Drosophila melanogaster*. Our results are consistent with parents passing the effects of ageing onto their offspring, but these effects depend upon the memory types and genetic resistance to oxidative stress. We are also disentangling the effects of maternal and paternal age on offspring memory, in which we predict a greater maternal effect of oxidation because epigenetic effects are more likely to be passed on through the egg yolk than through sperm proteins.

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Poster 32**Feeding association between cattle egrets (*Bubulcus ibis*) and mammal hosts  
in the central free state, South Africa**

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Field observations undertaken in agricultural areas and nature reserves of the central Free State indicate that cattle egrets mainly feed in commensalistic association with ungulates or even farm implements. A higher percentage farm animals than game was involved herewith. Based on calculated preference indices only three species, namely cattle (*Bos taurus*), buffalo (*Syncerus caffer*) and white rhino (*Ceratotherium simum*), qualified as key hosts. Eland (*Taurotragus oryx*), gemsbok (*Oryx gazelle*), impala (*Aepyceros melampus*) and horses (*Equus caballus*) were classified as major hosts, while the rest of the thirteen observed host species were identified as minor hosts. More than half of all feeding associations (58.4%) occurred during the mornings followed by a progressive decrease during the rest of the day. Depending on the host species involved, notable differences occurred in the time of association. Cattle were the only host species with which cattle egrets associated during any time of the day. Evidently, cattle egrets associated most often with larger host species that were actively grazing. In grassland habitats the birds mainly fed in front of grazing hosts, but behind those that moved fast.

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*Notes*

Poster 33**Social organization of a group of suburban free-ranging dogs**Cafazzo Simona<sup>1</sup>, Natoli Eugenia<sup>2</sup>, Fantini Claudio<sup>2</sup>, Valsecchi Paola<sup>1</sup><sup>1</sup>Dipartimento di Biologia Evolutiva e Funzionale, University of Parma, Via Usberti 11/A, 43100 Parma, Italy<sup>2</sup>Azienda USL Roma D, Ospedale veterinario, via della Magliana 856, 00148 Rome, Italy

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In westernized countries the presence of stray dogs is forbidden by law and only few citizens have more than two dogs. Therefore, there are not many social groups suitable for behavioural studies and intraspecific social relationships are poorly known. Moreover, the possibility that free-ranging dogs form stable social group was highly debated. The aim of this study was to analyse the social structure and the spacing pattern of a group of a free-ranging dogs (40-25 dogs) which could breed and move freely, but were dependent on human beings for food.

Data were collected (April '05-May '06) by 'focal animal sampling' and 'ad libitum sampling' methods. A linear dominance hierarchy based on direction of agonistic behaviour was found. The rank order did not change in different contexts. The home range of the group measured 61 ha. Group members cooperated to the territorial defence against intruders. Urine marking and ground-scratching behaviours are associated to territorial defence and are influenced by social status: high-ranking dogs mark more often than low-ranking dogs. Dominance rank and age influenced mate choice: adult females preferred high-ranking males and were more courted than young females. In spite of the process of domestication and the effects of artificial selection, this group of dogs behaves adaptively. In fact, in presence of an abundant food resource, dogs can form social groups which are similar, in structure and dynamics, to those of other species of canids.

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*Notes*



Poster 34

**Once a parrotfish, always a parrotfish?  
Interspecific differences in foraging behaviour  
and functional role of Caribbean parrotfishes**

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Herbivory is one of the most determinant biological processes on coral reefs. In the highly specialized fish communities of Indo-Pacific reefs, different herbivores can have strikingly different functions. We investigated the extent of functional diversity among herbivorous parrotfishes of the more species-depauperate Caribbean Sea. We carried out observations of seven species of parrotfish (*Scarus taeniopterus*, *Sc. vetula*, *Sc. iserti*, *Sparisoma viride*, *Sp. aurofrenatum*, *Sp. rubripinne* and *Sp. chrysopterus*) on four Barbadian coral reefs to collect information on foraging rates, targets and techniques. Parrotfishes of the genus *Scarus* had higher foraging rates than those of the genus *Sparisoma*. Live coral, turf algae and macroalgae were targeted in variable amounts among the species. A functional categorization based primarily on a unconventional criterion (foraging technique: contact or non-contact) and secondarily on the more conventional criterion of foraging target (macroalgae, turf algae, live coral) allowed us to classify *Sc. taeniopterus* and *Sc. iserti* as ‘scrapers’, *Sp. aurofrenatum*, *Sp. rubripinne* and *Sp. chrysopterus* as ‘grazers’, *Sp. viride* as a ‘bioeroder’ and *Sc. vetula* as a “bioeroder/scrapper”. This functional group affiliation, together with species-specific foraging rates, allowed us to predict the role of Caribbean parrotfishes on major coral reef processes and their impact on coral reef benthic communities.

Poster 35**Preference for Feline Images according to Their Sex and Age by Domestic Cats.  
A Pilot Study**Carloni Elena<sup>1</sup>, Accorsi Pier Attilio<sup>2</sup><sup>1</sup>Dept.of Evolutionary & Functional Biology, University of Parma, via G. Usberti, 11/A, I-43100 Parma, Italy<sup>2</sup>DIMORFIPA, Fac. Veterinary Medicine, University of Bologna, Ozzano Emilia (BO), Italy

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Forty-two neutered domestic cats were tested for their preference for photographs of intact male and female domestic cats and kittens. The experiment consisted in simultaneously presenting the subject cat with 3 items of an identical food treat, each one positioned in front of a life-size picture of, respectively, an adult tom, an adult female and a kitten. The trial was repeated 3 times for each experimental subject at a 14-day interval, using images of different individuals and shifting the spatial position of the male, female and juvenile's portraits in order to avoid orientation biases. On the whole, each experimental subject was presented with 3 different males', 3 different females' and 3 different kittens' pictures, each category being placed on turn on the right, the left and in the central position of the row of photographs. Experimental cats were unfamiliar to depicted subjects and tested singly, in a familiar room where the apparatus was completed by a set of camcorders. Initial orientation of the subject cat upon entrance, gaze and movement directions, time lag to approach and final choice of food item across trials were averaged for each subject and analysed. A consistent choice of the food item placed in front of one of the 3 age/sex categories of feline images was interpreted as a preference for (greater tolerance of) that category. Results are discussed in relation to the sex and social experience of the experimental subjects.

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*Notes*

Poster 36**Species-specific differences in the wing sac odour  
of two sympatric sister species of sac-winged bats**Caspers Barbara A.<sup>1</sup>, Voigt Christian C.<sup>2</sup><sup>1</sup>University of Bielefeld, Department of Animal Behaviour, Germany<sup>2</sup>Leibniz-Institute for Zoo and Wildlife Research, Berlin, Germany

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Bats are well known for their acoustic abilities in orientation and communication, but recent findings demonstrate that olfaction may as well be an important sensory modality for bats, especially in the context of social communication. The two sister bat species *Saccopteryx bilineata* and *S. leptura* that occur sympatrically throughout the Neotropics, occasionally share the same roosts, but never interbreed. Males of both species have sac-like organs with an odoriferous liquid in their propatagium. The wing sac scents are mixed of distinct secretions from various body regions and the scents of these wing sacs are used during greeting and courtship displays. We asked whether the wing sac scents might function as a pre-mating isolation barrier. We analysed wing-sac scents of male *S. bilineata* and male *S. leptura* using gas chromatography and mass spectrometry and compared the composition of wing sac odour between the two species. Furthermore we tested in an odour preference test, whether females prefer the odour of conspecifics over heterospecifics. If the wing sac odour functions as a pre-mating isolation barrier, females should prefer the wing sac scent of male *S. bilineata* to that of *S. leptura*. We present our results and discuss the potential of wing sac odour as a medium of species recognition as well as its potential function as a pre-mating isolation barrier.

Poster 37**Temperament, risk-taking behaviour and variations at physiological level  
in Alpine marmots (*Marmota marmota*)**Caterina Ferrari<sup>1</sup>, Denis Réale<sup>1</sup>, Achaz von Hardenberg<sup>2</sup><sup>1</sup>Université du Québec à Montréal<sup>2</sup>Parco Nazionale Gran Paradiso

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Predation acts one of the most important pressure on wild population promoting evolution of different strategies that allow animals to cope with predation risk; by this 'assumption' and seeing that individual temperament is playing a central role in several studies about animals' ecology, we study if individuals with different behavioural profiles vary in the degree of risk they take during their foraging activities and how can an individual adjust its antipredator strategy with difference degree of risk. Individuals of Alpine marmots represent a good model to study this question because they used to forage around their burrows and vigilance through frequent scanning of the territory surrounding where they have burrows entrance; Furthermore our work-area (Gran Paradiso National Park, Italy) presents two main species of marmots' natural predators, Golden eagle (*Aquila chrysaetos*) and Fox (*Vulpes vulpes*). We want to evaluate if results from open field test, individuals reaction scales, physiological parameters and hormonal analysis on blood samples are consistent with antipredator strategy carried out in the field by each individual; here we present how the growth in cortisol level can be assumed as index of individual stressability and how it is linked to variations in physiological parameters.

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*Notes*

Poster 38**Predictors of innovation in wild-caught  
Carib grackles (*Quiscalus lugubris*)**

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Behavioural innovation is rare in nature, and individuals differ in their propensity to innovate. In this study, we examine factors underlying these differences in wild-caught Carib grackles (*Quiscalus lugubris*). This species belongs to the second most innovative genus in the New World after *Corvus* (crows and ravens). We caught 36 adult male birds and tested them on their aggressiveness when handled, boldness, habituation, object neophobia, and latency to solve a novel problem-solving task. We first tested for relationships between measures, and found that individuals ranked differently on all behavioural tests preceding the innovation trials. Using a classification tree, we found that innovators were best classified according to object neophobia; innovators had low levels of fear. However, other behavioural measures were not significantly different between innovators and non-innovators. We thus used video analysis to quantify differences in solving strategies between innovators and non-innovators. Innovators were more persistent in creating and responding to informational cues from the novel task: Innovators probed the box, but quickly focused on areas causing movement of the lid, while non-innovators rarely caused the lid to move, and did not focus their attention of movement areas. Our results suggest that there is not an innovative behavioural 'type', but that innovative individuals may be more exploratory, and more responsive to information gained through exploration.

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*Notes*

Poster 39**Patch use and vigilance behavior by ibex in a risky environment:  
effectiveness of vigilance and the marginal value of energy**

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Foraging animals typically face a trade-off between food and safety, where better quality/quantity food patches usually mean higher exposure to predators. Adaptive behaviors can serve as tools to resolve this conflict; foragers may influence their safety by adjusting their use of time allocation and vigilance level in food patches differing in risk and/or feeding rates. Theory predicts that the use of vigilance should depend on its effectiveness in reducing risk. To test this, we manipulated the effectiveness of vigilance (EV) and the marginal value of energy (MVE) of free-ranging *Nubian ibex* in the Negev Desert, Israel. We altered EV by obstructing sightlines and MVE by providing food augmentations. *Nubian ibex* use cliff areas as refuges, thus we considered patches close to the cliff as safe and far away as risky. We assessed the foraging response of ibex by measuring giving up densities (GUD) in food patches and by focal animal observations of vigilance. Ibex were more vigilant and depleted food patches less thoroughly (left higher GUDs) in patches farther from the cliff (risky patches), with sightline obstructions (low EV), and when food was augmented (low MVE). This study demonstrated that Nubian Ibex adjust their vigilance and patch use behavior according to environmental factors, revealing how ibex perceive their habitat.

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*Notes*

Poster 40**What do females look at in male courtship  
in the rock sparrow (*Petronia petronia*)?**Cimadam Katja<sup>1</sup>, Pilastro Andrea<sup>1</sup>, Matessi Giuliano<sup>2</sup><sup>1</sup>Dipartimento di Biologia, Università degli Studi di Padova, V. Ugo Bassi 58/B, 35121 Padova (PD), Italy<sup>2</sup>Animal Behaviour Group, Department of Biology, University of Copenhagen, Universitetsparken 15, 2100 Copenhagen Ö, Denmark

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We investigated the properties of male courtship as a signal in male-female communication in the rock sparrow (*Petronia petronia*), a monomorphic passerine in which both sexes have a yellow breast patch and white spots on the tail. We provide a general description of courtship behaviour sequences both qualitatively and quantitatively. There was a negative correlation between courtship properties and the date relative to laying date, which means that courtship decreases when approaching egg deposition. There were inter-individual differences in the way males court females, which could provide the basis for female mate choice to occur. However, courtship did not seem to affect the behaviour of the females: when using a generalized linear mixed model, with the female's immediate response to courtship (copulation or copulation attempt) as the dependent variable, and the courtship variables, the observation date, the date relative to laying date and the identity of the female (extrapair or not) as the independent variables, the only variable that significantly explained the female's response was the date relative to laying date. Likewise, the amount of female parental investment could not be explained by the characteristics of the males' courtship displays. We discuss male adjustment of courtship properties to female receptivity, intra-sexual competition and choice of direct benefits (nest site) as some of the possible explanations for our results.

Poster 41**Ecological correlates of avian corticosterone secretion at fledging**

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Recently fledged birds suffer high mortality rates and factors underlying the nest departure decision can be viewed as major life history traits. Amongst possible factors, elevated levels of corticosterone (CORT), an avian stress hormone, and associated activity levels could intervene. To date, the mode of nesting (cavity vs open nest) is believed to be the main ecological factor acting on CORT secretion in fledglings. Elevated CORT have long-term deleterious effects if homeostasis is not rapidly recovered. Therefore, we propose that the distribution of food resources and the possibility to rapidly replenish energetic stores would rather explain inter-specific differences in CORT at nest departure. To test our hypothesis, we repeatedly measured CORT, activity levels and nutritional status before fledging in two semi-altricial, open-nesting species with markedly contrasted ecology: the White stork (*Ciconia ciconia*; abundant resources) and the King penguin (*Aptenodytes patagonicus*; sparse resources). In both species, fledging was preceded by a reduction of parental food provisioning. In White storks, chick food restriction resulted in an increase of CORT, activity levels and ultimately fledging. In King penguins, no changes in CORT was detected before departure to sea (fledging). We suggest that the chick adrenal sensitivity to food restriction before fledging should be retained when resources are abundant, and that it helps to stabilize the parent-offspring conflict.

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*Notes*



Poster 42**Impact of age and social rank on maternal odour attractiveness in the European rabbit**

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Lactating rabbit females (*Oryctolagus cuniculus*) emit abdominal odour cues that are attractive for pups. Here, we assessed in wild rabbits the impact of the females' social rank and age (collinear factors) on this activity. We predicted that in young, low ranking females, which are usually more stressed and have a lower body condition, the abdominal odour attractiveness should be lower as compared to older, high ranking ones. Thus, pairs of adult females from a field enclosure population were placed on a platform into an arena allowing pups (4 to 7-day-old) to perform a double-choice odour preference test when introduced under the platform. First, we evaluated the effectiveness of our device by testing lactating against non-lactating females. As expected, the pups showed a clear preference for lactating females by means of higher exploration time and typical searching behaviour under these females. In a second experiment, the choice was offered between lactating one-year-old, low ranking (Y/LR) and older, high ranking (O/HR) females. The results suggest a lower attractiveness of Y/LR females: Although the pups showed no significant preference in exploration behaviour, they preferably searched below the abdomen of O/HR females. In conclusion, the effectiveness of mother-offspring chemosensory communication is suggested to be modified by the mother's age together with her social rank, i.e. by a complex of factors that are strongly linked in rabbit females in the wild.

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Poster 43**Olfactory interference: is learning really similar in free-flying and restrained bees?**

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The honey bee worker *Apis mellifera* has been extensively studied for its learning abilities in free flying and restrained conditions. In free flying experiments, bees will learn the smell of flowers where they have found nectar. Similarly, in laboratory they can be trained to associate an odor to sucrose if the odor is presented immediately before the sucrose (forward pairing): the bee learns to extend its proboscis (its main mouthpart) in response to the trained odor. Several experiments have indicated that in spite of the unnatural situation of the laboratory (where they bees are restrained in small tubes), the information learned can be used in free-flying condition (and vice-versa). If a hungry bee in restriction is fed with sucrose, it will extend its proboscis during several seconds. However, we have discovered that if an odor is presented 15s after the sucrose (backward pairing), the bee will immediately retract its proboscis: this is the olfactory interference. This is also an inhibitory learning, because it impairs subsequent association between this odor and sucrose. However, this is not consistent with the free flying situation, where the bees backwardly learn flower features after having obtained food from them. We discuss this discrepancy, as well as potential neuroanatomical explanations. A same stimulus (i.e. the sucrose) can support opposite association according to the way it is paired with the odor (backward or forward, laboratory or free-flying).

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*Notes*

Poster 44

**Females go where the food is...**  
**Does the socio-ecological model**  
**explain variation in social organization of solitary foragers?**

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The socio-ecological model (SEM) links ecological factors with characteristics of social systems and allows predictions about relationships between resource distribution, type of competition and social organization. It has been mainly applied to group-living species but might also explain variation in social organization of solitary species. Here, we aimed to test predictions of the SEM in two solitary foragers, which differ in characteristics of female association patterns: (1) spatial ranging and (2) sleeping associations. Since 2002, we regularly (re-)captured and marked individuals of sympatric populations of *Microcebus berthae* and *M. murinus* in western Madagascar. We recorded data on spatial patterns and feeding ecology by means of direct observation of radio-collared females. Our results revealed differences in resource types used by the two species. *M. berthae* mainly fed on small, dispersed food resulting in scramble competition between spatially overlapping females and, thus, dispersed patterns. In contrast, *M. murinus* used patchily distributed, high quality food. Contest competition over these monopolisable resources allowed females to cluster spatially. Experimentally, we manipulated the spatial distribution of food sources and found that females adjusted their spatial patterns to food resource distribution. Thus, our results support basic predictions of the SEM and demonstrated that it can indeed explain variation in social organization of solitary species as well.

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Poster 45**Food imprinting: when cuttlefish babies deal with Tinbergen's 4 questions**Darmaillacq Anne-Sophie<sup>1</sup>, Bellanger Cécile<sup>1</sup>, Lesimple Clémence<sup>2</sup>, Dickel Ludovic<sup>1</sup><sup>1</sup>Groupe Mémoire et Plasticité comportementale, EA 4259, Université de Caen Basse-Normandie, Caen, France<sup>2</sup>Groupe Ethologie et Psychobiologie Sensorielle, CESG, Dijon, France

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Imprinting is a unique form of learning in animal and human. It has been controversial since it was first defined by Konrad Lorenz (Prägung). A major question is whether food imprinting (suggested by Burghardt & Hess in 1966) exists. Although extensively investigated in several models, no data has yet demonstrated unequivocally the involvement of imprinting in food selection by young animals. Furthermore, after 7 decades of investigations on imprinting, there is still no clear consensus about the nature of the imprinting process, the question being whether imprinting is simply an example of associative learning. Using a complex mollusk, the cuttlefish *Sepia officinalis*, we have demonstrated that prey preference in newly hatched cuttlefish is shaped by the sight of food during a sensitive window, shortly after hatching. Our data show unequivocally that this learning is distinct from associative learning because the learning took place days before the animals' first meal (reinforcement), ruling out any "primacy effect" from the first food ingestion. Last, the effects of food imprinting overcome those of the first food experience. Another exciting finding is that it probably takes place before hatching.

Poster 46**Does personality influences the use of public information during mate choice?**

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Interindividual variation in personality, or temperament, has become of prime importance for behavioural ecologists. Still, the relevance of the concept of personality in mate choice studies has received so far little attention. In particular, little is known about the relationship between personality and the use of public information during mate choice. We designed an experimental study to assess to what extent individuals with different personalities would be influenced by public information during mate choice. To that end we first quantified behavioural syndromes in female zebra finches, *Taeniopygia guttata*. We then experimentally studied mate choice copying in the same individuals in order to correlate the use of public information with personality. We discuss our results in relation to the relevance of the personality concept in studies of sexual selection.

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*Notes*

Poster 47**Choosiness, but not preference, is repeatable in female zebra finches mate choice**

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Individual variation in mate choice behaviour is of central importance in sexual selection studies. However, individual consistency in female mate choice has received, so far, little attention. We investigated mate choice consistency in zebra finch, a monogamous and dimorphic passerine bird, in a classic four-chamber choice-apparatus. Each female was tested twice, before and after a period of cohabitation with a male. Female preference for a particular individual was not repeatable either before or after cohabitation with a male. However, choosiness, defined as deviation from random choice, was found highly repeatable between females across these trials. Thus, whereas some females tended to show little or no preference for any male in any trial, other clearly preferred a male during each trial, but not necessarily the same one from trial to trial. We discuss the relevance of our results for studies of mate choice and personalities in birds.

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*Notes*

Poster 48**Hormonal and behavioural correlates of cooperation  
in female Norway rats, *Rattus norvegicus***

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Female wild type Norway rats, *Rattus norvegicus*, differ in their propensity to cooperate in a two-player sequential food-exchange task. These individual differences may form part of a larger package of correlated behaviours expressed across different behavioural contexts and referred to as behavioural syndromes. In this study we have (1) identified correlates of cooperative behaviour throughout ontogeny by repeatedly testing the animals for their 'activity', 'emotionality' and 'sociality' in standardised test paradigms, e.g. the elevated plus maze, and (2) checked for physiological mechanisms of cooperation by analysing the effects of the experimentally administered neuropeptide oxytocin on the propensity to cooperate and other behaviours. Oxytocin recently has been shown to increase trustfulness in humans, and previous studies have suggested that oxytocin also affects other components of social behaviour in humans, including the willingness to cooperate. Our experiments reveal potential physiological and behavioural mechanisms of cooperation and behavioural syndromes in female wild type Norway rats, viewed within an evolutionary framework.

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*Notes*

Poster 49**Females that become more female-like and males more male-like with age perform better in the barn owl**

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Age-related changes in secondary sexual characters are controlled by genetic and biochemical factors and, hence, may covary with changes in life history traits which expression relies on the same regulatory factors. To understand the ultimate function of melanin-based traits as well as the proximate mechanisms underlying these functions, we studied within individual changes in sexually dimorphic melanin-based plumage traits in the barn owl (*Tyto alba*), and tested for correlations with changes in reproductive parameters. During the yearling moult occurring between the 1st and second 2nd of life, both females and males became consistently less pheomelanic, females displayed larger melanin spots and males fewer spots. The extent of these changes was not associated with coincident changes in reproductive performance. However, at subsequent moults the simultaneous changes in melanin traits and in reproductive success were correlated. Adult females laid earlier and larger eggs the year after they became whiter or scattered with larger spots, while adult males produced larger broods the year after they became whiter and displayed fewer black spots. The extent of the within-individual changes in plumage traits was neither heritable nor condition-dependent. These results suggests that the production of melanin pigments during moult and other fitness-related life history traits are concomitantly regulated in adult barn owls, potentially in a strategic way.

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Poster 50**Is fitness of southern elephant seals *Mirounga leonina* related to their foraging grounds? Stable isotopes document winter trophic ecology of adult females at Kerguelen Islands**

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Individual specialization can affect population dynamics. We examined whether intra-specific niche variation influenced reproductive fitness in the southern elephant seal, whose females were known to forage in two different areas. We used pups as bio-indicators of their mothers' biology and combined information on their weaning mass (a proxy of females' short-term fitness) together with their blood  $^{13}\text{C}$  value (a proxy of female foraging zone). We first validated the use of pup isotopic signature to study the female foraging ecology by demonstrating that  $^{13}\text{C}$  and  $^{15}\text{N}$  values of pups and their mothers were positively and linearly correlated. Then, we blood-sampled and weighed a large number of newly-weaned pups to work at the population level.  $^{13}\text{C}$  values of females encompassed a large range of values (from -23.73 to -19.12‰), whose frequency distribution showed a single mode, suggesting no contrasted foraging areas within the population. No significant relationship was found between pup weaning mass and their carbon signature, indicating no link between female foraging areas and their foraging success. However, pup weaning mass and  $^{13}\text{C}$  value were correlated to pup weaning date, suggesting that heavier (likely older) females arrived later to breed from higher latitudes. Finally, blood  $^{13}\text{C}$  and  $^{15}\text{N}$  values gave new insights into the seal ecology, suggesting that females mainly foraged north of the Polar Front where they preyed upon myctophid fish in winter.

Poster 51**The importance of alert distance in flight initiation distance of alpine marmot (*Marmota marmota*) : a cost/benefit approach.**Dumont François<sup>1</sup>, Réale Denis<sup>1</sup>, Pasquaretta Cristian<sup>2</sup><sup>1</sup>UQÀM, Montréal, Québec, Canada,<sup>2</sup>U. Pavia, Pavia, Italy

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Following the economical model by Ydenberg and Dill (1986) the distance at which a prey initiates flight (flight initiation distance or FID) corresponds to the distance at which the risk of predation equals the cost of fleeing. This model predicts that a prey does not initiate flight as soon as it detects a predator. Risk of predation increase quickly when prey is not aware, forcing it to monitor predator behavior. The benefit of staying in place drop to 0 at the alert distance (AD) – the distance at which an animal detects an approaching threat and alter its behavior. So, AD should alter FID and be optimized. In this paper, we verify the relationship between AD and FID in alpine marmot (*Marmota marmota*) in the Gran Paradiso National Park (Italy), and test for the effects on AD and FID of environmental variables potentially linked to risk of predation and to the cost of fleeing. The 41 tests on 14 marked individuals revealed a strong relationship between FID and AD ( $r^2 = 0.7$ ;  $P < 0.0001$ ) that demonstrates that alpine marmots flee little after being alerted of the threat. The importance of initiation distance demonstrated that the risk of predation increase rapidly right after the beginning of the threat. Both AD and FID are optimized, but factors that are influencing AD and FID are different. Attraction of FID by AD can be explain by cost/benefit approach link to vigilance. DA should be a better indicator of the sensitivity to disturbance and be use in nature conservation.

Poster 52**Pair-bonding in zebra finches: do males care more than females ?**

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Zebra finches (*Taeniopygia guttata*) are highly gregarious songbirds that form life-long pair bonds. The stability of these reproductive and social bonds between mates determines the organisation of the group. Beside these heterosexual pairs, is there any same-sex interaction? In this study, we report the relationships set up in social groups with varied sex ratio. Adult males that live without any female form same-sex pairs. They display the whole behavioural repertoire of heterosexual pairs (allopreening, courtship, nest construction, singing activity, absence of aggression) and their bonds are not split up with females' arrival. On the contrary, females in same-sex group do not show these monogamous social bonds. In order to test the hypothesis that males – and not females – initiate pair formation according to the available partners, we observed groups with males/females sex-ratio of varied values. Same-sex pair appears neither in group of balanced sex-ratio nor in group of 2:1 males/females sex-ratio. Males only courtship females, and the unlucky ones which do not succeed to pair keep on trying even if the available females are paired. We hypothesize that same-sex pairs are by-products of male zebra finches' motivation to form pair-bonds essential to their social organisation.

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Poster 53**Do free-ranging deer discriminate between different minerals?**

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One of the basic assumptions of foraging behaviour is that animals should first seek to fulfil threshold levels of all required nutrients. Many organic nutrients can be created by metabolic reactions, but others (e.g. minerals) can only be obtained from the diet. Thus, to behave as optimal foragers, animals should be able to discriminate among minerals and detect their contents in plants. This has been known to occur in cattle with regard to Na and P. Our aim was to assess if wild deer can discriminate among different minerals offered in a cafeteria test in SE Spain. Because some of them have a narrow range between adequate and toxic levels,  $\text{Ca}(\text{IO})_3$ ,  $\text{CuSO}_4(\text{H}_2\text{O})_5$ ,  $\text{Na}_2\text{SeO}_3$  and  $\text{ZnSO}_4(\text{H}_2\text{O})$  compounds were added to NaCl. Potassium chloride (KCl), MgO,  $\text{FeCO}_3$ , NaCl and  $\text{Ca}_3(\text{PO}_4)_2$  were placed unmixed.

The cafeteria test showed that free-ranging deer can discriminate among different minerals even if they are mixed with such a strong flavoured mineral as common salt. Deer had a strong preference for  $\text{Na}_2\text{SeO}_3$  and  $\text{ZnSO}_4(\text{H}_2\text{O})$ , a weaker attraction to pure NaCl and  $\text{Ca}(\text{IO})_3$ , and no intake of  $\text{CuSO}_4(\text{H}_2\text{O})_5$ ,  $\text{Ca}_3(\text{PO}_4)_2$ , KCl, MgO and  $\text{FeCO}_3$ . Mineral consumption was highest in spring and summer and moderated during the autumn and winter. No consumption was recorded during September and October, which coincides with the mating season. Deer may have been using the supplemented mineral during antler growth, late gestation and early lactation, when the physiological effort is at the highest level.

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*Notes*

Poster 54**Goup size and neighbour distance effects on feeding behavior in male and female house sparrow, *Passer domesticus* L.**

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Several factors influence feeding rate and vigilance in bird species such as group size, neighbour distance, sexual dimorphism and so forth. A group is described as a collection of individuals within a radius regardless of whether companions can influence the feeding behavior of each other. However, it is known that neighbour distance can affect behavior of individuals. Besides, because of sexual dimorphism there are intersexual differences in feeding behavior in birds. Social dominance has also been suggested to be a driving force for differences in foraging behavior in a bird species. The aim of this study to find out the role of both group size and neighbour distance on feeding behavior of male and female house sparrow, *Passer domesticus* which has sexual dimorphism. Constant size food was supplied in natural area. Male and female feeding behavior was compared based on the feeding rate and vigilance. In both sex, intake rates decreased in solitary bird. It was determined that feeding rate and vigilance were effected both group size and neighbour distance in *Passer domesticus*.

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*Notes*

Poster 55**Cultural learning of predator recognition in mixed species assemblages:  
the effect of tutor-to-observer ratio**

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Animals living in social groups have the opportunity to acquire information about foraging opportunities, mates, and predators. Traditionally, social learning has been studied in birds and mammals, but very few tests have been conducted on other taxa considered less social. Moreover, few studies have considered cross-species learning among members of mixed species assemblages. Here, we showed that tadpoles of the boreal chorus frog (*Pseudacris maculata*) do not display a fright response to the odour of predacious tiger salamanders (*Ambystoma tigrinum*) without prior experience with salamanders, but they can learn to recognize the salamanders when they are paired with predator-experienced woodfrog (*Rana sylvatica*) tadpoles. Moreover, the efficacy of learning is enhanced when the ratio of tutor-to-observer increases. Social learning has far reaching implications for survival of individuals in mixed species assemblages.

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*Notes*

Poster 56

**Consumption behaviour and discrimination of mineral supplements  
in *Cervus elaphus hispanicus* (Hilzheimer, 1909).**

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All mammals have the ability to taste salt, but they also seem to have evolved the ability to detect phosphorus and consume both of them according to their needs, as these are the most limiting minerals for ungulates in wild. However, other minerals are also essential and often present in limiting quantities. Thus, some authors have proposed that ungulates may be also foraging looking for Ca, Fe, or Zn. The aim of this study was to assess if red deer can discriminate among minerals by examining their free-choice consumption behaviour of eleven supplemented minerals. Fifty-nine hinds and their calves were monitored during two lactation periods. NaCl, KCl, CaCO<sub>3</sub>, FeCO<sub>3</sub>, MgO, and Ca<sub>2</sub>(PO<sub>4</sub>) were offered as single compounds; meanwhile CoSO<sub>4</sub>(H<sub>2</sub>O)<sub>7</sub>, CuSO<sub>4</sub>(H<sub>2</sub>O)<sub>5</sub>, Ca(IO)<sub>3</sub>, Na<sub>2</sub>SeO<sub>3</sub>, and ZnSO<sub>4</sub>(H<sub>2</sub>O) were mixed with NaCl at different concentrations to avoid toxicities, but also to detect discrimination among similar salted flavours. Supplements were weighted weekly and consumption behaviour was determined by two cameras (individual frequency of visits and time per visit). Calves showed behavioural indices of consumption greater than hinds, as did young hinds compared to old hinds. Hinds only consumed NaCl, meanwhile calves consumption behaviour was different among most salt flavoured supplements but also between Ca<sub>2</sub>(PO<sub>4</sub>) and CaCO<sub>3</sub>. Results suggest red deer discriminate minerals beyond Na and P.

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*Notes*

Poster 57

**Growing up into personality? Influence of age and personality  
on reactions of bird predators to aposematic prey**

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Some elements of behaviour are rather stable in ontogeny and are recognised as personality traits (coping styles). Personality traits in great tits (*Parus major*) play an important role in their survival and success. Two different personality types have been identified: (1) fast explorers are quick, aggressive, routine forming, less thorough in exploration and less cautious

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Poster 58**To stay or to keep going: Migratory decision at a stopover site**Fusani Leonida<sup>1</sup>, Carere Claudio<sup>2</sup>, Goymann Wolfgang<sup>3</sup><sup>1</sup>University of Ferrara, Italy,<sup>2</sup>University of Groningen, The Netherlands,<sup>3</sup>Max-Planck Institute for Ornithology, Germany.

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Many diurnal birds migrate mainly or only at night. Previous work has shown that in blackcaps (*Sylvia atricapilla*) and garden warblers (*Sylvia borin*) night melatonin is lower when birds show migratory restlessness (Zugunruhe) during the migratory seasons compared to resting birds during the sedentary seasons. Similar changes in night melatonin were found when blackcaps underwent a food regime that simulated a long migratory flight - fasting - and a subsequent refuelling stopover. There was a suppression of nocturnal activity and an increase in melatonin in the night following food reintroduction, and the strength of the response depended on the amount of fat reserves. Thus, we advanced the hypothesis that fat reserves at arrival to the stopover site determine changes in melatonin and Zugunruhe. In the last years we studied garden warblers, whitethroats, and winchats at a spring stopover site. Birds trapped at the Ponza ringing station were temporarily hosted overnight in individual cages to record Zugunruhe. In a subset of birds, a blood sample was taken to measure night melatonin concentrations. We found that the amount of subcutaneous fat at capture is the best predictor of Zugunruhe, which is in turn the best predictor for melatonin plasma concentrations. These results suggest that nutritional factors determine the behavioural response to food availability, and that the reduction of night melatonin during migration could result from increased nocturnal activity.

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*Notes*

Poster 59**Effect of temperature increase on the courtship behavior  
and the fitness in the Palmate newt**

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A trend in global warming is now undeniable. Increases of global temperatures have resulted in measurable shifts in the distribution, phenology and survival of some plant and animal species. However, the mechanisms showing the link between global warming and declines remain unclear. The aim of this study was to examine whether courtship displays and fitness could be affected by a temperature increase. To this end, we compared the sexual behavior and egg-laying traits at naturally occurring temperatures (14 C, 18 C and 22 C) in palmate newts (*Triturus helveticus*). First, our results underline the importance of female role in the male courtships. The majority of male behaviors are affected by the female responsiveness, which is temperature dependent. They also show that water temperature increase has a negative effect on the fecundity of female newts. Females lay half as many eggs at high temperatures as they do at low temperatures and of these only one third hatch. The demonstration of such a detrimental effect shows that more experimental studies are required to understand the proximate mechanisms of global warming.

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*Notes*

Poster 60**Immune response and rank in female Iberian red deer (*Cervus elaphus hispanicus*) during lactation.**

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Aggressive interactions among red deer females are commonly observed and have been often overlooked. These interactions included kicking and biting in the ear and side and they lead to the establishment of a social rank that conditions the access to resources, such as food or nest sites. This aggressiveness is at highest levels during lactation, which is the most demanding stage of reproduction. The aim of this study was to analyse the relationship between dominance rank and immune response, assessed by white blood cells count during this stage. To perform it, 24 female Iberian red deer hinds were blood sampled at the right jugular vein, and samples (6 per animal) were analysed with ADVIA® A120 Hematology System (Bayer). Social rank hierarchies were assessed by analysing aggressive interactions matrices with Matmam 1.1 software. They were comprised between 0 (value for the subordinate hind) and 1 (value for the dominant hind). The statistical procedure was performed with SPSS 15.0. Dominance rank correlated negatively to leukocytes and lymphocytes counts (Pearson's coefficients). According to these results, subordinate hinds had to address a higher amount of resources to immunity, since they have to face the higher pathogens exposure due to the wound generated by the interactions, mainly the bites.

Poster 61**Territorial interactions between wild and farmed juvenile Atlantic cod (*Gadus morhua* L.)  
in a laboratory setting**

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Wild juvenile cod live in shallow coastal waters where they may defend territories around shelter sites. Commercial farming of cod is a fast growing industry in Norway, and the net pens used to grow cod are often placed in the same areas used as nurseries by wild cod. Escapes of farmed fish are inevitable, and these escapees may affect wild populations in several ways. There is concern that farmed cod would be more aggressive than their wild counterparts. If so, escapees may displace wild cod from their territorial sites, potentially lowering their growth and survival. This study examines the effect of prior residence on interactions between juvenile wild and farmed cod in a laboratory setting. To that end we introduced cod into an already inhabited shelter site. All possible combinations of wild –farmed and resident-intruder were tested, and a range of behaviours to determine level of aggression and dominance were analyzed. The results are discussed in terms of environmental and genetic influences on agonistic behaviour in relation to a prior residence effect.

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*Notes*

Poster 62**Is plasticity able to create a Babel Tower  
between allopatric fish populations?**

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Traditionally, reproductive isolation between populations has been thought to emerge as a result of the accumulation of different mutations, genetic drift, or through the effects of natural and sexual selection. That is the case in the Amarillo, (*Girardinichthys multiradiatus*), a viviparous fish from Central México with an elaborated courtship pattern and effective female mate choice, where we already proved that allopatric populations are diverging. Although the causes of such divergence remain unclear. Using the same species, we analyzed the pattern of displays performed by males when courting females from different populations and the responses of females to those displays. We found that the population-characteristic male courtship behaviour is modified in the presence of females from other populations, that this is due to the males responding to subtle cues from females, and that they fail to emulate the female's population-characteristic behaviour. We conclude that in spite of behavioural plasticity, local dialects in the courtship patterns hamper communication between heterogametic individuals and promote pre-mating isolation.

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*Notes*

Poster 63**Supplemental feeding and dawn singing in chickadee**

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The dawn chorus in the black-capped chickadees has been hypothesized as a condition-dependent signal, as dominant males display a higher song output than subordinates, and birds in poor-quality habitat (young forest) sing less than those in higher-quality habitat (mature forest). In both cases, it has been suggested that variation in food availability - between dominant and subordinate territories or between mature and young forests - may explain these differences. However no direct evidence of an effect of food availability on chickadee song output at dawn exists. To directly test whether food availability affects song output, we conducted a food supplementation experiment in the field by establishing dyads of fed/unfed birds with the two birds within a dyad otherwise being paired by rank and habitat. Each fed bird received approximately 3.5g of mealworms every two days for a week prior to the recording. Fed birds had significantly higher song output during the dawn chorus than their unfed counterparts. Our results confirm that food limitation influences song output at dawn in the black-capped chickadee.

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*Notes*

Poster 64**Conspecifics and heterospecifics interactions within a rare contact zone.**

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Black-capped chickadee (*Poecile atricapillus*) and mountain chickadee (*P. gambeli*) are the closest genetic sister-species within the genus *Poecile*, yet they typically have allopatric distributions due to differences in habitat preference. Mountain chickadees are typically associated with coniferous habitat whereas black-capped chickadee prefer mixed forest with a higher deciduous component. However in northern British Columbia forestry practices create a mosaic of coniferous and deciduous forests which may induce overlapping populations, and possible hybrids have been anecdotally reported in this region. Black-capped chickadees are known to have a stable social hierarchy in winter flocks and rank influences breeding status of males. We will present data on the inter and intra-specific interactions at temporary winter feeder to testing the presumption that black-capped chickadees are the dominant species. Using data on relative feeder usage rates, we will determine whether chickadees show evidence of interspecific avoidance. Using data from individually banded birds, we will determine whether contests between combatants matched for age and sex show consistent dominance of one species over the other. As dominance status is known to influence territoriality and mate choice, interspecifics interactions might influence hybridization potential between these two species.

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*Notes*

Poster 65**Female presence is required for male sexual maturity  
in the entomopathogenic nematode *Steinernema longicaudum***

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Solitary-reared males of *Steinernema longicaudum* remain sexually immature until exposed to a female. Only following exposure to a female (but not another male) for a sufficient period of time do males become fertilisation competent, and the seminal vesicle contains sperm. The requirement of a male animal for female presence before he becomes fertilisation competent is previously unreported. In experiments carried out in insect blood, most males required at least 18 hours with a female before the seminal vesicle contained sperm. In contrast, most solitary-reared females were ready to mate and were fertilised by a sexually mature male within one hour. Males separated from females by a permeable barrier produced as many sperm as males that were in physical contact with females, indicating that male maturation is mediated by chemical cues released by females. Solitary males also failed to mature sexually in the more natural conditions of a host insect cadaver. We suggest that this unusual requirement of a male *S. longicaudum* for a female to be present before he produces viable sperm is related to the habitat of the reproductive populations within dead insects. A mature female cannot suddenly arrive in the vicinity of a male; she must enter the insect as a juvenile and mature there. We further suggest that arrested sexual maturation of a solitary male *S. longicaudum* is an adaptive strategy to conserve resources for survival until a potential mate enters and develops in the host.

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Poster 66**Egg quality of female grey partridges paired with preferred males**

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In oviparous species maternal effects are largely prenatal and females allocate several substances in their eggs depending on the environment experienced before or during egg formation. The quality of the partner can profoundly influence the female investment and in some species it has been shown that male attractiveness can influence the maternal investment in yolk carotenoids and hormones. Among the substances that the mothers allocate in a clutch, those deposited in the albumen have been little studied. The albumen proteins that constitute the innate antibacterial immune defence (lysozyme, ovo-transferrin and avidin) seem to be relevant in terms of fitness prospects. For example, in some bird species it has been shown that egg lysozyme enhances hatching success, chick's health and survival.

We studied egg quality in Grey Partridges subjected to a choice test between two partners. After the tests, one group of females was paired with the preferred male, while the other was paired with the non-preferred male. We could verify the importance of antibacterial immune defence as a maternal effect, since we showed that avidin concentration covary with hatching rate. We did not find significant increases in lysozyme and avidin concentrations in the eggs of females paired with the preferred males, while there was a significant increase in testosterone concentration. This result suggests that only yolk and not albumen substances are influenced by behavioural conditions in our species.

Poster 67**Prenatal stress influences behavioural features in young birds**

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The individual's behavioural development is notably influenced by his social environment and particularly by his mother. This maternal effect occurs after youngster's birth but also before. In mammals, prenatal maternal stress influences the setting up of youngster's behaviour; this influence results from the modulation of the mother's plasmatic levels of steroid hormones. In birds, a similar maternal influence also exists, implicating a modulation of steroids levels in the egg. Indeed, egg's hormonal levels are influenced by laying females' environment and an artificial steroids' enrichment of eggs modulates the behavioural phenotype of resulting chicks. However, no study has investigated yet the whole mechanism of maternal prenatal influence in birds (i.e. from the mother to the offspring). Thus, our aim was to analyse the impact of stress on the laying female on her eggs' hormonal composition and on the behavioural features of her offspring. Therefore, we applied stressors on laying females in a precocial bird, the Japanese quail. Our results showed that the prenatally stressed chicks appeared to be more emotive with a higher social motivation and also a slight increase of steroids in the eggs of stressed females. Thus, in this study, we show for the first time that, in birds, stress on the laying female has a significant impact on the behaviour of her offspring via a hormonal change in her eggs.

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Poster 68**Study of differential behavioral effects between the synthetic predator odor 2,4,5-trimethylthiazoline (TMT) and cat odor, in relation to TMT concentrations**

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Among predator odors, 2,4,5-trimethylthiazoline (TMT), a synthetic component of red fox glandular anal secretions and cat odor are frequently used in the investigations of fear induced by olfactory stimuli in rodents. In published experiments, TMT was always used at pure concentration to provoke responses relative to fear and anxiety. These responses were often different to those observed with cat odor (Staples et al., 2008 \*). In a previous study, we found that pure TMT, 50% TMT and 10% TMT induced significative avoidance, anxiety and freezing behaviors, compared to natural fox feces, probably due to a possible TMT irritating component (Buron et al., 2007 \*\*) which activated the trigeminal nerve. The aim of this work was to mesure avoidance (in a corridor shape-maze) and anxiety (in an elevated plus-maze) effects in mice exposed to natural cat odor and low concentrations of TMT (1%, 0.1% and 0.01%). Results showed that cat odor didn't induce avoidance behavior contrary to TMT whatever the concentration. In contrast, cat odor induced anxiety behavior in the same way as 1% TMT and 0.1% TMT. These results are in accordance with our previous study demonstrating that the avoidance behavior was probably due to the irritating component of chemical stimuli whereas the anxiety behavior was probably due to the olfactory component, suggesting that cat odor is a pure olfactory nerve stimulus.

\* Neuroscience; 2008, 151: 937-947.

\*\* Behavioral Neuroscience; 2007; 121: 1063-1072.

Poster 69**The initial evolution on aposematism: a paradox revisited**

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Aposematic insects advertise their defensive toxins to potential predators using conspicuous warning colours, which predators readily learn to avoid. However, the initial evolution of conspicuous colouration is problematic, because if a distinct conspicuous morph arises in a cryptic species, it will be more easily detected and at a greater risk of being attacked and killed. However, many insects have externally detectable defences and may be taste-rejected by predators – could this behaviour provide a solution to this problem? Using domestic chicks (*Gallus gallus domesticus*) foraging on coloured chick crumbs, we have found that defended conspicuously coloured crumbs are more likely to be rejected when they are attacked compared to equally-defended cryptic crumbs. Since it is well established that many insects can survive a predatory attack if they are rejected, we conducted a second experiment using live prey to test whether prey are more likely to survive an attack if they are conspicuously rather than cryptically coloured. Our experiments support the idea that taste-rejection behaviour in predators could promote the evolution of conspicuous aposematic signals. However, colour biases and defence levels are also important, and their role in the initial evolution of conspicuous colour signals also need to be considered.

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Poster 70**Avian Cognition and the Initial Evolution of Aposematic Insects**

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Aposematic insects conspicuously advertise their unprofitability to potential predators who are known to learn that a prey is unprofitable more easily if it contrasts in some way with its background. However, the evolution of conspicuous colouration is problematic, because if a distinct conspicuous morph arises in a cryptic species, it is assumed to be at a greater risk of being detected and killed. This argument however, does not consider the fact that many insects have externally detectable defences and thus may be taste-rejected by predators. Using a system of domestic chicks foraging on coloured crumbs we tested whether a rare conspicuously-coloured defended morph can have a selective advantage over a cryptic defended morph when defence chemicals can be detected before ingestion by a naïve predator. We find that naïve birds can learn to avoid defended prey when they are conspicuous but not when they are cryptic. Crucially, when prey ingestion, and not attack probability, is used as our measure of mortality we find that there can be a selective advantage to being conspicuous in a cryptic population. This advantage can occur even in the first avoidance learning trial, providing an initial selective advantage for rare conspicuous defended morphs. However, this does not occur in all conspicuously coloured prey populations, and it is evident that colour biases are important and their role in the initial evolution of conspicuous colour signals should be considered.

Poster 71**Uncovering the varying roles of personality in pairs of foraging fish**

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The concept of personality traits is a fundamental aspect of human behaviour but it is only more recently that the idea of consistent variation between individuals has been shown across the wider animal kingdom. Whilst studies of animal personality are now becoming an increasingly important topic for behavioural ecologists, very little work has yet been done to investigate how varying personality types may interact. When three-spined sticklebacks (*Gasterosteus aculeatus*) are observed foraging alone they can be described as showing consistent variation in levels of 'boldness'. Here, we study the impact that variation in boldness has when fish forage in pairs. Allowing relatively 'outgoing' and relatively 'shy' fish to forage with each other, all fish increase their activity levels in the presence of a partner. We show that foraging outcomes are affected by their own innate boldness levels but are also strongly influenced by the specific behaviour of a foraging partner. This suggests that personality type may influence the roles taken by interacting individuals and highlights the importance of considering individuality when studying group dynamics.

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Poster 72**Female aggression and egg composition in the collared flycatcher (*Ficedula albicollis*)**Hargitai Rita<sup>1</sup>, Herényi Márton<sup>2</sup>, Török János<sup>2</sup><sup>1</sup>Institute of Environmental Sciences, College of Nyíregyháza, Nyíregyháza 4400, Sóstói út 31/B, Hungary,<sup>2</sup>Behavioural Ecology Group, Department of Systematic Zoology and Ecology, Eötvös Loránd University, Budapest 1117, Pázmány P. st 1/C, Hungary,

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Offspring survival can be influenced by the resources allocated to the egg, which in turn may be affected by the environmental and social factors the mother experiences during egg formation. Maternally-derived testosterone, immunoglobulin and antioxidants are thought to have profound effects on the development and competitive ability of the nestlings. In this study, we experimentally investigated whether socially stressful conditions at the time of rapid yolk deposition influence yolk composition of a hole-breeding passerine, the collared flycatcher (*Ficedula albicollis*). Social stress was simulated by presentation of a conspecific caged female near the nestbox during the follicular developmental period of the resident female. Females spent more time in the nest-site during the experimental treatment and produced eggs with smaller yolk and higher testosterone concentration compared to control females. Moreover, we found that females breeding at higher density produced eggs with smaller yolk. Females in higher density areas may be constrained in foraging time due to aggressive encounters or there might be lower food supply as a result of increased competition for food. Females may interact with unmated female floaters that may settle as secondary females. In that case, higher investment of yolk androgens could be adaptive for the primary female, as testosterone enhances the nestlings' begging behaviour, which in turn may elevate male contribution to the nestling feeding.

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Poster 73**Evaluation of fear and aggressiveness of military patrol dogs during a standardised test**

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Dogs, *Canis familiaris*, belong to social species and are skilful at communicating with humans. This ability relies on socialisation which, whether is not correctly established, can lead to fear and aggressiveness. In a military context, undesirable aggression and disobedience among the Belgian military working dogs have been reported. It affects efficiency of the team handler-dog, the security of the military staff and the dogs' welfare. Thus, a new dogs training process, recruitment and handlers formation systems have been implemented. Two groups of dogs, actual method (control group = 31 dogs) and new method (experimental group = 36 dogs), have been tested to identify undesirable aggression, by the way of a behavioural test and are compared. Both groups are representative of the military canine population. We used the only scientifically validated test for aggression, the MAG test (Netto & Planta, 2001). It takes into account dog's aggressiveness, postures, oral behaviour and yawning revealing fear. Those behaviours were recorded on videotape and subsequently analysed. The lowest posture and the highest level of aggression observed during each of the 16 subtests were scored. We compare the two groups with an ANOVA. We will discuss the efficiency of the new method in terms of reduction of fear and aggressiveness, and the relevance of the MAG test as a useful tool to diagnose aggressive behaviour in those dogs.

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Poster 74**Assessment of human-dog's interaction during obedience and protection work exercises.**

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Human-dog interaction is more and more studied. It is proved that dogs can be very performant, even more than apes, when interacting with humans. Most authors agree that these performances are due to 10 000 years of social experience with human. This periode have genetically predisposed dogs toward the recognition of human gesture. However, only few authors study working dogs. In a study, Haverbeke A. et al (2008) found that military working dogs aren't as performant as they are expected to. We investigate on this paradox. We supposed that working dogs suffer from this social interactions deficiency. Performance of obedience and protection work exercises was compared in two groups of working dogs: the control group is trained with the actual Belgian army's training method. The experimental group underwent a new training method. During obedience exercises, the experimental group presents better results than the control group. Concerning the protection work exercises, more stastical tests are required to confirm the effects of the new training method. So it seems that, even if dogs are genetically predisposed toward the recognition of human gesture, this aptitude alone doesn't explain the performances of dogs, when interacting with human. A familiarisation period, containing regular and positive interactions with the handler, is also required during the training in order to have good dog-handler comprehension.

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Poster 75**Famine Relief in Ant Colonies**

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An essential process in the social life of ants is the transmission of liquid food among all colony members inside the nest. The ecological success of ants suggests that this is achieved without compromising the security of the colony by simultaneously spreading harmful substances. Here we investigate the mechanisms, pathways and networks ants use to transfer food within colonies of *Temnothorax albipennis*. Colonies inhabit flat rock crevices and their workforces have a strong spatial structure within the nests. We analyse four colonies, all with individually marked workers and compare behaviour when food is provided after a period of famine with that under control conditions. We show that the distribution of food within colonies is much faster after a famine, though in the process some of the spatial structure of the workforce is temporarily abandoned. We use a simple analytical model and networks of interactions between ants to describe rates and pathways of food transmission. We also identify a new role for certain workers which is likely to have interesting implications for how colonies simultaneously facilitate the distribution of resources whilst inhibiting the spread of harmful substances.

Poster 76**Does song complexity matter in an intra-sexual context  
in Common Blackbirds?**Hesler Nana<sup>1</sup>, Sacher Thomas<sup>2</sup>, Coppack Timothy<sup>3</sup>, Mundry Roger<sup>4</sup>, Dabelsteen Torben<sup>1</sup><sup>1</sup>Animal Behaviour Group, Department of Biology, University of Copenhagen, Universitetsparken 15, 2100 Copenhagen Ø, Denmark,<sup>2</sup>Institute of Avian Research, Vogelwarte Helgoland, An der Vogelwarte 21, 26386 Wilhelmshaven, Germany,<sup>3</sup>University of Zuerich, Zoologisches Museum, Winterthurerstr. 190, 8057 Zuerich, Switzerland,<sup>4</sup>Max Planck Institute for Evolutionary Anthropology, Deutscher Platz 6, 04103 Leipzig, Germany,

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Bird song is thought to be subject of both inter- and intra-sexual selection and song complexity a signal of male quality. One aspect of song complexity, repertoire size, correlates with estimates of male quality in several passerine species.

The Common Blackbird (*Turdus merula*) has a large repertoire of different song patterns which are organized in a complex structure without fixed song types. Previous studies found that Blackbirds show large individual differences in repertoire sizes and use these repertoires in both inter- and intra-sexual contexts. In this study we investigate the signal value of repertoire size in Blackbirds in an intra-sexual context with the hypothesis, that males use the repertoire sizes of rivals as a cue to assess their quality. We conducted playback experiments in which we broadcast songs of conspecifics with different repertoire sizes to the test birds. The responses will be discussed in relation to the test birds own repertoire sizes.

Poster 77**Which factors affect timing of egg ejection in a Cuckoo host?**

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Appropriate reaction time is required for optimal decision-making and coordination of various behavioural components. In this study we investigated factors affecting the timing of egg ejection in an important Cuckoo (*Cuculus canorus*) host, the Great Reed Warbler (*Acrocephalus arundinaceus*). To simulate Cuckoo parasitism, we presented a Cuckoo dummy near host nests, experimentally parasitized the clutches by a non-mimetic egg and filmed host behaviour. We fitted general linear models with ejection time as dependent variable and other factors (size and number of host eggs; date of egg laying; volume of experimental egg; colour clutch characteristics; female body condition and behaviour on the nest) as explanatory variables. The minimal adequate model revealed that egg ejection was quicker in females breeding earlier, having larger and brighter eggs as well as spending more time by checking the nest contents. This is the first study analyzing proximate and ultimate factors affecting timing of egg ejection in a host species. (Funded by GAAV A600930605, GA&#268;R 524/05/H536.)

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Poster 78**Breeding in a human modified environment:  
the case of the feral pigeon (*Columba livia*)**

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Urban environment has been radically modified by human influences. Buffering of temporal variability of climatic factors and resources availability, artificial light, supplemental food provided by human refuses and feeding, were proved to alter behaviour and reproduction patterns of animals, especially birds. This might be particularly true for one of the most human dependent birds living in town, the feral pigeon *Columba livia*, which is furthermore subject to recent regulation programs through reproduction control in pigeon houses. We studied breeding behaviour of feral pigeons in pigeon houses around Paris and highlighted two types of breeding cyclicity. We proved that reproduction of this species has a clear seasonal component, but the determination of the proximate factors influencing the timing of reproduction needs further investigations. We also highlighted a shorter cyclicity shifting from 4 to 10 weeks under the influence of human management. This populational study was completed with an individual approach focusing on the impact of management on maternal investment, in order to have a better insight into the underlying adaptation mechanisms. This study will help us understand how a species living in a highly human modified environment might react to urban context and human management, and may be used for the development of better management protocols to promote sustainable cohabitation in town.

Poster 79**Breeding synchrony in colonial birds:  
from local stress to global harmony**

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Why and how birds in colonies often breed in striking synchrony is an unsolved question. We propose and test a mechanistic explanation based on an adaptive individual behaviour. In colonies, conspecific birds often destroy eggs and kill chicks. It is thus adaptive for females to wait until achieving a certain degree of social tranquillity in their neighbourhood before laying eggs. We propose that social quietness can be achieved if a bird's agitation is partly determined by the nervousness of its neighbours. Also, that this local process, together with environmental cues, can synchronize breeding between neighbours and by the whole colony. We tested our hypotheses using a generic individual-based model implemented in NETLOGO v. 3.1.4, where the breeding predisposition of females was daily updated depending on an increase in the photoperiod (positively) and the stress level of neighbours: negatively if they were nervous, and positively otherwise. Females decided to lay eggs when reaching a lower stress level threshold. Even giving only a low relevance to the neighbour's stress level was enough to synchronize the laying date of neighbours and also of a whole colony of 10,000 nests. Moreover, by giving this relevance to neighbours, females bred in a more peaceful environment, which is known from field studies to increase their fitness. Our study highlights the power of local adaptive (individual) behaviour to create global (colony) patterns.

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Poster 80**Host manipulation by parasites:  
evidence for enhanced trophic transmission to an appropriate final host**

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Parasite-induced behavioural alterations observed in hosts are generally regarded as the product of natural selection acting on the manipulating parasite. However, alterations in host behaviour following infection can only be considered adaptive for the parasite if they can be shown to increase its fitness. We investigated the specificity of predation by bullhead (*Cottus gobio*) upon *Gammarus pulex* infected with two types of acanthocephalan parasites: *Pomphorhynchus laevis*, for which the bullhead constitute the final step of its lifecycle, and *Polymorphus minutus* for which the bullhead is a dead end. In a microcosm experiment, we confirmed that *P. laevis*-infected intermediate hosts were more susceptible to predation than uninfected ones, whereas *P. minutus*-infected intermediate hosts were less predated than uninfected ones. In a second experiment, we showed that *P. laevis* inhibits the normal hiding reaction of uninfected prey in the presence of a bullhead, whereas *P. minutus* did not. In a final odour choice experiment using a Y-maze, we showed that uninfected gammarids were repulsed by the scent of a bullhead whereas *P. laevis*-infected ones were attracted to it and *P. minutus* infected hosts simply did not respond to the bullhead odour. Our results suggests that the phenotypic alterations induced by manipulating parasites can be targeted at a particular definitive host, and that chemical communication can be an efficient way for parasites to reach their suitable final host.

Poster 81**Studies on a new microsporidia species isolated from the silkworm, *Bombyx mori* L**

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A microsporidian spore(microsporidia sp.AB) isolated from the silkworm, *Bombyx mori* L was purified and characterized according to its ultra structure, spore surface protein, serology and pathogenicity. From the observations of the isolate by scanning and transmission electron microscopy, the endospore, exospore and nuclei with about 12 polar filament coils of the polar tube were identified. The polyclonal antibody raised against the microsporidia sp.AB raised in rabbits reacted positively but could not cause agglutination with the spores of *N. bombycis*. The spore surface protein showed 10-major polypeptide bands ranging from 205-14.00kDa. The pathogenicity against silkworm was quantified by inoculating  $1 \times 10^6$  to the zero day of 2nd instar larvae that resulted in the death of 60.33% individuals. These observations suggest that this isolate could be different from existing microsporidia viz.*N.bombycis*, *Nosema* sp.M11, *Nosema* sp.M12, NIAP-6p etc of the silkworm though seemed closely related to genus *Nosema* so far as sporohous vesicle enclosing one spore, presence of rigid exospore , smooth endospore, number of coils of polar filament as well as expression of different peptide bands & pathogenicity to the silkworms is concerned

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*Notes*



Poster 82**Control of copula duration: how males and females manipulate sperm transfer**

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In polygynandrous mating systems, sexual conflict can arise on the number of partners and on the reproductive investment of each sex. Particularly, traits that control sperm transfer can have quite different optima with regard to female and male fitness. Indeed, female behaviour may have evolved to ensure fertilization, favour preferred male through longer copulation or promote post-copulatory mate choice. Males may strategically allocate their sperm according to female reproductive quality, sperm competition risk and further mating opportunities. Behavioural mechanisms have been poorly studied in taxa, such as reptiles, where sperm transfer is driven by copula duration rather than by the number of copulations. In the present study, we investigate in the common lizard whether males and females control copula duration. In a sequential mating context, we study how mate choice and copulatory behaviours vary with individual quality (e.g. coloration, social dominance, fitness-related physical performances) and mating history. We principally disentangle the respective role of both sexes in this conflict for sperm transfer.

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Poster 83**Baboon Despots**

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Group-living animals may benefit through coordinating their activities. This requires that individual group members choose, between mutually exclusive actions, and reach a ‘consensus decision’. However, achieving this can be difficult when groups are heterogeneous in composition and individuals vary in their optimum preferences. Two alternate modes of decision-making have been proposed to allow animals to manage this conflict of interest: decisions can be made democratically in an ‘equally shared’ manner, or alternately, decisions can be ‘unshared’ where all group members accept the decision of dominant members. Here we report the results of a quantitative study of group foraging decisions of the chacma baboon, *Papio ursinus*, under conflict of interests resulting from strong competition for food resources. We show that group members accept a decision dictated by a sub-majority of dominant individuals, for decision outcomes that differ in potential costs, and in groups of different sizes. This study suggests that unshared decisions play an important role in coordinating group behaviours for animals in complex social groups; moreover, we show that costs to followers in such situations are most likely less significant than previously thought, by reason of indirect cooperation benefits derived from their association with leaders.

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*Notes*

Poster 84**Measuring aggregative patterns in cockroaches using real-time automated technology**

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Groups of animals are often required to reach a consensus about where to move, feed, or rest. In some species, these decisions emerge from a combination of individual choice and attraction to group members, without the need for complex negotiating behaviours. Here, we use radio-tagging methodology to reveal how behavioural patterns adopted by individual cockroaches, *Periplaneta americana*, result in group-level patterns of aggregation. We conducted experimental trials in which groups of 11 cockroaches were presented with opportunity to rest under one of two shelters, which were either the same or different in their light quality. Like previous studies, our results show that individuals were attracted to conspecifics as a consequence of a positive feedback mechanism. In addition, we show that: (1) Modulation of the strength of social positive feedback enhanced individual discrimination between a light and a dark shelters. (2) Variation in individual behaviour within groups did not affect the overall decision outcome (i.e. shelter choice), indicating a robust self-organising mechanism. (3) Individuals exhibited higher levels of exploratory behaviour when faced with a choice of two poor quality (i.e. light) shelters. These results provide further insight into how self-organising processes can lead to collective behaviour. Moreover, real-time monitoring of individuals offers much promise for quantifying the behaviour of individuals within the context of the collective.

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Poster 85**Family differences in behavioural and physiological stress coping in farmed salmon:  
Relationship to disease resistance and growth**

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Farmed fish are exposed to an environment they are not necessarily well adapted to, and which may be unpredictable and uncontrollable with several potential stressors. The aims of this study have been to investigate potential differences in stress responsiveness between family groups of farmed Atlantic salmon. Behavioural and physiological responses to confinement stress were monitored in 92 juvenile salmon from 10 different families. Locomotor activity during acute stress, aggression towards territorial intruders, and water-borne cortisol titers were registered. Mean values for each family were related to central parameters from the breeding company's registers (Aquagen ASA), such as selection value for growth and disease resistance. Averaged family values for water borne cortisol concentrations correlated positively with locomotor behaviour during confinement, supporting the idea that more stress sensitive fish is identified by increased locomotion during acute stress. Furthermore, our results also revealed a positive correlation between locomotor behaviour during confinement and resistance to Infectious Pancreas Necrosis Virus. Finally, aggression correlated in a curvilinear way to cardio somatic index ( $R^2=0,98$ ) and mid parent selection-value for growth ( $R^2=0,62$ ). In other words, offspring of both the most slow-growing and the most fast-growing parents were characterized by enhanced aggression towards an intruder.

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*Notes*

Poster 86**Distinct behavioural strategies in pike (*Esox lucius*):  
the links of habitat use, activity and energetic demand**Kobler Alexander<sup>1</sup>, Klefoth Thomas<sup>2</sup>, Mehner Thomas<sup>2</sup>, Arlinghaus Robert<sup>3</sup><sup>1</sup>University of Antwerp, Department of Biology-Ethology, Campus Drie Eiken, Universiteitsplein 1, 2610 Antwerp (Wilrijk), Belgium,<sup>2</sup>Leibniz-Institute of Freshwater Ecology and Inland fisheries, Department of Biology and Ecology of Fishes, Müggelseedamm 310, 12587 Berlin, Germany,<sup>3</sup>Leibniz-Institute of Freshwater Ecology and Inland fisheries, Department of Biology and Ecology of Fishes, Müggelseedamm 310, 12587 Berlin, Germany; Humboldt-University of Berlin, Faculty of Agriculture and Horticulture, Institute of Animal Sciences, Inva,

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Habitat partitioning has been demonstrated between species but recent examples indicate heterogeneous habitat use also within single populations. Pike (*Esox lucius*) is a littoral sit-and-wait predatory fish. However, anecdotal evidence suggests that pike individuals differ with respect to habitat preference and swimming activity. Therefore, we hypothesized that distinct behavioural types of pike exist within a single population. 17 female pike were radio-tagged and weekly tracked in 24 hour cycles from June to September 2005. Cluster analysis of habitat use and swimming distances at day and night were used to identify three behavioural types, namely habitat opportunists (N=8), submerged plant selectors (N=4) and reed selectors (N=5). These behavioural types did not differ in size, age, or life-time growth pattern. In contrast, they differed significantly in activity with the habitat opportunists being most active. Due to the increased energetic costs of swimming, the estimated annual consumption was 2.52 times higher for habitat opportunists and 1.58 times higher for submerged plant selectors as compared to reed selectors. The higher energy demand of more active fish was balanced by the higher encounter frequencies with prey, since prey densities were identical in all habitats. We conclude that behaviour and resource use in pike is density-dependent, such that alternative habitat and activity types emerge when the littoral pike density exceeds a critical threshold.

Poster 87**Resource distribution mediates male reproductive success  
through its effect on territory defensibility**

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Male reproductive success often depends on their ability to defend territory and aggressive behaviour associated with territoriality may suppress population productivity by restrains of female spawning rate. We used *Rhodeus amarus*, a small cyprinid fish that spawns in spring for a period of about 3-6 weeks. Male bitterling establish territories around mussels and attract females to spawn inside the mussel gill cavities. We investigated effect of the number and spatial distribution of mussels on reproductive behaviour and success of male bitterling in a large outdoor pool. We arranged 4 and 12 mussels in clusters or individually along the pool perimeter and recorded male territorial aggression and courtship rate. We further counted the total number of eggs laid by the population over 24 hours and their distribution between territories and mussels. We found that the overall number of eggs per day was significantly higher when 12 mussels were used, but the mean number of eggs in one mussel was significantly higher for the treatment with 4 mussels. At regular mussel distribution, territorial males were able to defend their territories and courted females for a longer time. At clustered mussel distribution, territorial males were unable to defend territory and most spawnings involved sperm releases by a group of males with sperm competition determining paternity. Females spent more time by skimming and inspecting mussels (measures of female choosiness) at clustered distribution.

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Poster 88**Food provisioning of prospective mates in a cichlid fish**Kotrschal Alexander<sup>1</sup>, Taborsky Barbara<sup>2</sup><sup>1</sup>Behavioural Ecology, Zoological Institute, University of Berne, Switzerland,<sup>2</sup>(1) Ecology & Evolution Program, International Institute of Applied Systems Analysis, Laxenburg, Austria; (2) Behavioural Ecology, Zoological Institute, University of Berne, Switzerland,

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Food provisioning of potential mates may provide males with a two-fold benefit: it may convince females to mate with a male, and females may have a higher reproductive output due to the male's energetic contribution. If provisioning is costly, males should guard the food against all individuals except prospective mates. A range of algae grazing fish defend feeding territories against other grazers. In the maternally mouthbrooding cichlid *Simochromis pleurospilus* males defend small territories vigorously against con- and heterospecific food competitors, but allow some females to feed in them prior to spawning. We tested the hypothesis that this selective tolerance by males constitutes food provisioning of prospective mates. Since females produce a large clutch of energy rich eggs and do not feed when mouthbrooding, they may gain substantial direct benefits by an energy boost prior to egg laying. Additionally, the quality of offered algae may serve females as cue for potential indirect benefits. Using extensive observational field data we show (i) that only certain females are tolerated on male territories and (ii) that females, which are tolerated, receive less aggression, need to move around less to obtain food, and feed at higher rates than when grazing outside of male territories. We propose that males offer undisturbed feeding opportunities in high-quality territories only to receptive females and that this behaviour serves a courtship function.

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Poster 89**Behavioural and physiological responses to challenges  
in male greylag geese (*Anser anser*)**

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Stressful challenges cause compound autonomic, endocrine and behavioural responses. Still, cardiac, endocrine and behavioural changes were almost never studied simultaneously, particularly in birds. In five free living ganders, implanted with heart rate transmitters, we simultaneously recorded heart rate (HR), levels of excreted immuno-reactive corticosterone metabolites (BM) and behaviour over a period of two hours after (a) capture, handling and injection with ACTH, (b) capture, handling and injection of a saline solution (SHAM) and (c) an unmanipulated control. BM significantly increased after ACTH, but not after SHAM. HR initially increased similarly after ACTH and SHAM, followed by a decline during the second hour post treatment. Actually, mean HR in the second hour after ACTH was significantly lower than mean HR in both control conditions. Geese showed the most significant behavioural changes in the first hour after ACTH injection. Compared to both control conditions, we observed less agonistic behaviours, resting and feeding, but more locomotion and preening as well as more wing flapping after ACTH. Behavioural changes after SHAM relative to the unmanipulated control resembled those after ACTH, but were less pronounced. Particularly, SHAM did not affect wing flapping, a behaviour in male birds discussed as an indicator of arginine vasotocin(AVT) activity. Funding by the FWF (P18744-B03, P18601-B17).

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*Notes*



Poster 90

**Early fasting is long lasting:  
Effects of early nutritional stress reappear under stressful conditions  
in adult female zebra finches (*Taeniopygia guttata*)**

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Conditions experienced during early life can have profound effects on individual development and condition in adulthood. Nutritional stress in birds during this phase can lead to reduced growth and lower reproductive success and survival. Here, we investigated long term consequences of early nutritional stress in non-domesticated female zebra finches. Subjects had experienced no nutritional stress or nutritional stress as nestlings or fledglings and when adult we tested their resting metabolic rate, their sensitivity to periods of food restrictions as well as their exploration and foraging behaviour. The results reveal that early nutritional stress affects adult exploration behaviour and physiology specifically when conditions become constrained. Shifting compensation costs for early development stress to constrained conditions in adulthood might be an adaptive strategy as it would allow individuals to be fully competitive under favourable environmental.

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Poster 91**Photoperiodical and social effects on the onset of puberty  
in female cavies (*Cavia aperea*)**

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Individuals face profound consequences of the timing of reproductive events. They gain fitness by adjusting reproduction to social and environmental conditions. Previous studies demonstrated strong influences of social factors on timing of puberty in cavies (*Cavia aperea*). However, it remained unclear whether this was a consequence of differing stress levels depending on different social rearing conditions or due to specific signals from the social environment. Different social environments did not cause differences in cortisol levels. We show that photoperiod exerts a potent influence on maturation. We tested two groups of female offspring of cavies born into simulated (by changing light:dark rhythms) spring and autumn, respectively. Pups born into decreasing daylength (from 14.5h -> 12h light) had a significantly delayed onset of maturity (mean 84.2 days SE  $\pm$  4.6) while pups born into increasing daylength (10h -> 12.5h light) matured much earlier (49.4  $\pm$  3.9). The social conditions (young females kept with males, castrates or alone) did not affect stress level, but strongly affected onset of maturation (with males mean 32.5 days SE  $\pm$  3.9, with castrates 41.2  $\pm$  4.5, alone 62.5  $\pm$  10.9). The onset of puberty in female cavies is highly affected by photoperiod. This makes sense given that pups born late in the year need to survive the adverse winter conditions before successful reproduction is likely whereas pups born in early summer can reproduce within the same season.

Poster 92**Memory accelerate during post-natal development**

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A new memory becomes stabilized over time through a process of consolidation, which requires protein synthesis. Moreover, a trace previously consolidated could be rendered labile when retrieved and this reconsolidation process requires another phase of protein synthesis to maintained memory trace in the long term. The temporal dynamics of consolidation and reconsolidation of taste aversion memory are evaluated during post-natal development: 3, 10 and 18 days old. This is assessed through the temporal gradient of efficacy of a protein synthesis inhibitor (anisomycin) in inducing amnesia either after acquisition (consolidation) or reactivation (reconsolidation). The results show a progressive reduction with age of the delay during which the inhibitor is able to induce amnesia. Control experiments rule out a reduction of anisomycin efficacy due to blood brain barrier growth or decrease in protein synthesis inhibition. Thus, these results present the first evidence suggesting that there is an acceleration of memory processing with age. This acceleration occurs in parallel for consolidation and reconsolidation. Such changes in the dynamics of memory processing could participate to the cognitive improvement associated with development.

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Poster 93**Individual differences in behavioural responses in five behavioural experiments – looking for common vole (*Microtus arvalis*) personalities**

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Correlated suites of behaviour, recently coined ‘behavioural syndromes’ or ‘animal personalities’ have important implications for our understanding of the ecology and evolution of behaviour. Identifying correlations among behaviors is important for understanding how selection shapes the phenotype; these correlations may also have substantial fitness consequences.

The aim of our study was to determine the degree of consistency of common vole individual differences in behavioural responses over time and across different experimental situations. First-generation laboratory-reared voles were individually subjected to the same set of five behavioural experiments – (i, ii) two types of an open field test, (iii) voluntary running in a running wheel, (iv) exploration and orientation in a radial arm maze, (v) male response to a scent marking of a standard male intruder – and we used a linear mixed-model approach to show the occurrence of interindividual variation in behavioural reactions. We discuss the role of a heritable component.

Poster 94**Does selective early-life mortality weaken the behavioural antipredator skills of captive-reared Arctic charr?**Lautala Tiina<sup>1</sup>, Roff Derek A.<sup>2</sup>, Hirvonen Heikki<sup>1</sup><sup>1</sup>Department of Biological and Environmental Sciences, P.O. Box 65, FI-00014 University of Helsinki, Finland,<sup>2</sup>Department of Biology, University of California, Riverside CA 92521, USA,

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Hatchery-born salmonids commonly have low post-release survival due to weak antipredator and foraging skills. One possible reason for the weak ability to survive in nature is selective mortality during early life stages in the hatchery rearing. The individuals that cope well in the dense hatchery conditions may have low changes of survival in nature, whereas the individuals that die might have been well adapted for living in the wild. We reared 28 Arctic charr families with a half-sib breeding design, to resolve whether hatchery survival is genetically correlated with their innate antipredator behaviour, tested in a Y-maze. We found no evidence of selection associated with behaviour during egg stage, yolk-sac stage, first exogenous feeding or the following 1.5-month period. During a subsequent 1.5-month period, however, the families with the highest average antipredator responsiveness (avoidance and freezing) had significantly lower survival. The period was associated with a raise in the water temperature that was likely to increase stress and susceptibility to infections among the fish. The results support the hypothesis of selective hatchery mortality being one of the causes of low survival of hatchery-born, wild-released fish. Therefore, the rearing practices should be improved to reduce the loss of individuals that would survive in nature.

Poster 95**Role of immune regulation in individual homeostasis**

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The immune system plays a very important role in the defence against parasites. Consequently, individuals with the most efficient immune response should be selected by natural selection. However, there is a huge variation among individuals in their capacity to mount an immune response. An over-reactive immune response confers obvious benefits (elimination of parasites) but also costs (too many metabolic resources allocated to the immune system). Therefore, immune regulation may be an important trait for individual homeostasis. To assess the role of immune regulation, we investigated the balance between its costs and benefits. We injected canaries (uninfected or experimentally infected with the parasite *Plasmodium relictum*) with cyclophosphamide in order to inhibit the regulation of the immune response. Two different factors have been tested: infection by parasites and the dose of cyclophosphamide on bird body mass, hematocrit, survival and parasite intensity. We hypothesize that inhibition of immune regulation should on the one hand increase parasite resistance, but on the other hand decrease other host fitness components.

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Poster 96**Courtship feeding, copulation and female deception  
in the Whiskered Tern *Chlidonias hybrida***

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In many bird species males provide their mates with food prior to egg-laying. The intensity of courtship feeding affects the clutch quality and reflects the male's ability to parental investment. A female can obtain immediate benefits by trading copulations for food with her mate. Also, she can get additional food by trade copulations for gifts with a strange male. However, such a situation involves several types of risk: fertilization by a male of unknown quality or one with poor genes, transfer of parasites, reduction in partner care, or partner punishment. Females seem to trade copulations for food only with high quality males which bring prey more energy-rich than that provided by her mate.

In this study I investigated the frequency of courtship feeding and copulation in the Whiskered Tern in carp ponds abounding with food. I found a temporal link between courtship feedings and copulations. I found that males tried to trade food for copulation with females that were not their mate. Only in two cases females allowed cloacal contact. Some females very often deceived a strange male. They begged for copulation and when a male jumped on their back, they immediately tore the food from his bill and drove him away. The success of taking the gift away was higher when the female encouraged the male to mount her than when she did not. These data suggest that females of monogamous species can effectively obtain additional food from strange males without cuckolding their own partner.

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Poster 97**Male mate choice under sperm competition risk in bank voles**

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Recent studies have begun to reveal the importance of male mate choice in behavioural ecology, despite previous assumptions of its relatively minor role in sexual selection. Theoretical models predict the conditions under which male mate choice is expected; for example, when costs of mating increase, males should become more stringent in their choice. The aim of our study is to test these predictions in a promiscuous rodent: the bank vole (*Myodes glareolus*). Our experiments are designed to investigate (1) the basis of potential male mating preferences in this species (e.g. with respect to female relatedness, age, weight or scent marking); (2) whether male dominance status (which predicts average mating and fertilisation success under sperm competition) affects such mating preferences; and (3) whether sperm depletion affects the stringency of male mate choice, due to an increase in the cost of male choice. Further studies will also be presented to investigate if male bank voles adjust their copulatory behaviour and ejaculate allocation strategies (e.g. number of intromissions, ejaculations with each female) according to potential indicators of female quality.

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Poster 98**Vibratory courtship by male spiders cryptically increases paternity success**

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Costly courtship signals are generally proposed to influence mating success. The vibratory courtship display performed by spider males on the orb-webs of females is suggested to signal species identity and to pacify aggressive, predatory females. However, females of the spider *Argiope bruennichi* never attack nor reject a male before mating although sexual cannibalism after mating occurs regularly. Still, males usually perform about 5 minutes of energetic display prior to a copulation of a few seconds. However, as soon as a rival male appears on the scene, they skip courtship and directly go for copulation. Males that copulate without courtship do not mate longer nor are they cannibalized more frequently than courting males. So, why do males bother to court at all? We tested whether courtship may influence paternity success under polyandry. We created males that copulated without courtship by using a rival with his sexual organs amputated and therefore unable to mate. After copulation, the first males were removed and the females mated with a second male. Using the sterile-male-technique, P2 values were compared between the treatment (no courtship by 1st male) and control groups (with courtship). Males that mated without display had a reduced paternity share even though no differences in cannibalism or copulation duration were detected. Hence, courtship appears to generate an advantage in relative paternity success under sperm competition realized through cryptic processes.

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Poster 99**Influence of social status on learning and memory  
in a murine model of Alzheimer's disease**

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Neurodegenerative disorders such as Alzheimer's disease (AD), which are characterised by an advancing cognitive decline are increasingly threatening public health. It has been demonstrated in many species that health can be influenced by the social status of an individual. Thus, the question arises if social rank influences learning success in transgenic (tg) mice modelling AD. First, social status of male mice raised in a spacious semi-naturalistic environment (SNE) was investigated by direct behavioural observations along with automated RFID-techniques that allowed to gather positional data of mice. Second, social status of male tg mice was analysed in an emigration setup (ES) that allowed subdominant mice to escape from dominant ones. For all mice learning was examined using a spatial learning task. In the SNE, mice established a complex social hierarchy comprising several territories being dominated by either a tg or a wildtype male. Dominant mice triggered significantly more antennae contacts than subdominant animals indicating that the RFID-system applied here may facilitate behavioural observations. In the SNE, a general genotype effect was found on learning success, with tg mice showing impaired learning performance compared to wildtype mice. In the ES, no difference in learning abilities existed between dominant and subdominant tg mice indicating that the social status of an animal seems to have no impact on learning abilities of tg mice exhibiting AD-like pathology.

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Poster 100**Social foraging in the German cockroach *Blattella germanica* (L.)**

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Eusocial insects have developed sophisticated communication systems through which individuals indicate the localisation of valuable food sources to their nestmates thus optimizing colony foraging strategies. Food recruitment is often characterized by asymmetries in the exploitation of food sources and can be described in terms of self-organised processes. Although the use of social information in foraging is well known in Hymenoptera, it has rarely been evidenced in other group-living insects that feed on patchy non renewable food sources.

Here, we report for the first time social foraging in the cockroach *Blattella germanica* (L.) and investigate both proximate and ultimate causes of this behaviour. Groups of cockroaches given a simultaneous choice between two identical food sources exploit them asymmetrically, resulting in the selection of a unique source by the group. The asymmetry amplitude is density dependant and the dynamic of exploitation can be described by non linear models. Hungry cockroaches are attracted significantly by feeding conspecifics, suggesting the occurrence of food calling. This communication system induces the formation of aggregates on a selected food source and collective exploitation. The presence of conspecifics not only facilitates food discovery but also influences individual feeding strategies by prolonging feeding duration. We discuss the implication of cooperation and social foraging in the evolution of sociality in cockroaches.

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Poster 101**Optimal level of inbreeding in the common lizard**

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Mate choice with regard to genetic similarity has been rarely considered as a dynamic process. We tested for such a possibility on breeding populations of the common lizard kept for several years in semi-natural conditions. We investigated whether a pattern of mate choice existed according to genetic similarity and was context-dependent. Mate choice depended on partners' genetic similarity, but without systematic inbreeding avoidance. Actually it was strongly age- or condition- dependent. Females of intermediate ages, more monogamous, do not mate with genetically similar partners whereas younger or older females, more polyandrous, did but sired more offspring with the less related of these males. These results support the hypothesis of dynamic mate choice, suggesting that individuals of different phenotypes select their partners in different ways according to their genetic similarity. We confronted our results with different and apparently contradictory theories on genetic compatibility such as optimal inbreeding or inclusive fitness

Poster 102**Influence of testosterone on the stress response  
of male Guinea Pigs around puberty**

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Late adolescent male guinea pigs have a lowered endocrine stress response compared to animals in other developmental stages, which is dependent on the housing conditions: in response to a mild stressor, colony-housed males show a reduced increase of cortisol (C) levels, whereas pair-housed males show an increase comparable to the one occurring in other developmental stages. It was hypothesized that the interaction with conspecifics leads to an increase in testosterone (T) concentrations, which, in turn, reduces C responsiveness. To test this hypothesis, the stress response of pair- and colony-housed animals was compared with that of pair-housed animals that had limited opportunities to interact with unfamiliar animals of both sexes (social stimulation). The following results were obtained: 1) On day 120 (late adolescence), colony-housed males showed a significantly lower increase in C levels than pair-housed males, with C secretion in socially stimulated males being intermediate. 2) Basal T levels in colony-housed males were significantly higher on day 120 than on day 55 (early adolescence). 3) Basal T levels on day 120 were significantly higher in colony-housed males than in socially stimulated males, which had marginally lower basal T levels than pair-housed males. A connection between social stimulation and a lowered stress response can therefore be assumed. Testosterone results indicate that T might play a role in suppressing the C response in adolescent male guinea pigs.

Poster 103**Are inter-population differences in boldness consistent over age in Eurasian perch?**Magnhagen Carin<sup>1</sup>, Borcharding Jost<sup>2</sup><sup>1</sup>Dept. of Wildlife, Fish, and Environmental Studies, Swedish University of Agricultural Sciences, SE-901 83 Umeå, Sweden,<sup>2</sup>Department of General Ecology & Limnology, Zoological Institute of the University of Cologne, Germany,

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Differences in behaviour patterns can be found between intra-specific populations that live in locations differing in some significant features, such as predation risk. Variation in behaviour can depend on innate personality features, but could also be a result of learning from experience. In Eurasian perch, *Perca fluviatilis*, we have earlier found differences in risk-taking behaviour between young-of-the-year perch from populations differing in size-specific predation risk. To see whether these differences are consistent over age, we compared the behaviour of two age-classes (0+ or 1+ years) of perch, from two lakes differing in density and size-structure of predators. Groups of perch were given the choice of foraging in an open area or hiding in the vegetation in the presence of a piscivore. A principal component analyses were used to calculate individual boldness scores from a combination of behaviour estimates. The mean boldness scores corresponded well with estimated size-specific predation risk in the two lakes, and differences between lakes switched between age classes. In the youngest age class, perch from Ängersjön were bolder than those from Fisksjön. In the older age class, the Fisksjön perch were bolder than those from Ängersjön. Within lakes, boldness differed between age classes. It seems like perch can adjust risk-taking behaviour to perceived predation risk, and thus, boldness would depend more on experience than on fixed individual behaviour differences.

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*Notes*

Poster 104**Territorial aggression is lower in resident  
than migratory European stonechats**Marasco Valeria<sup>1</sup>, Canoine Virginie<sup>2</sup><sup>1</sup>Department of Animal Biology and Genetics Leo Pardi, University of Florence, Italy,<sup>2</sup>Max-Planck Institute for Ornithology, Germany,

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In spring, a large number of birds migrate to northern regions that provide for short periods abundant food for raising offspring. The short reproductive window leads to intense aggressive behavior at the beginning of the breeding season for establishing a territory to guarantee resources and thus reproductive success. The migratory European stonechats (*Saxicola torquata*) are particular in that they establish and defend pair wise a territory at both their breeding and wintering sites, which means that they are highly aggressive in both seasons. As in other temperate birds, aggressive intensity changes depending on the reproductive state of the breeding pair and between seasons. Here, we compared aggressive behavior throughout different breeding cycles and seasons in resident Stonechat population in Italy. Because this population remains within the same territory throughout the breeding and non-breeding season, the reproductive window is prolonged. We asked the following questions: 1. Are resident stonechats as aggressive as migratory stonechats? 2. Does aggressive behavior change throughout the breeding season and between seasons in resident stonechats? Our results show that resident stonechats are less aggressive than migratory stonechats. Moreover, changes in aggressive behavior throughout the reproductive seasons and between the breeding and non-breeding seasons are much less pronounced than in migratory stonechat populations.

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*Notes*

Poster 105**Effect of food conditions before laying on coloration  
of protoporphyrin-pigmented eggs: a post-mating sexual signal?**

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How and what coloration informs about in birds has been a central issue in the last decades. However, little is known about the meaning of egg coloration in birds. A recent idea suggests that egg coloration may act as a post-mating sexual signal, used by males to adjust their parental effort. This idea and also that egg pigmentation is positively related to egg quality have been supported. However, there are three main aspects that remain to be explored: the cost of egg pigmentation, certify this idea in non blue-green colored eggs and the role of UV reflectance. We explore these ideas in a food-supplementation experiment before egg formation, in the Eurasian kestrel, a cavity nester species that lays brownish eggs. We did not find any relationship with female condition and contrary was just male condition that best predicted egg colouration. We found that hatching success and egg mass, were positively related to egg colouration in food supplied pairs but not in control ones. In addition, we found that UV reflectance increases as brownish colouration decreases, revealing a contrasting tendency. Our results support the idea that egg colouration is costly to produce. However, our results do not support the idea about the potential role of egg pigmentation as a post-mating sexual signal although egg colouration may signal egg quality.

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*Notes*



Poster 106**Vulnerable vipers vomit:  
experimental manipulation of thermoregulation & safety**

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Loosing a prey represents an energy cost for infrequent feeders. Loosing life is certainly a higher cost. In snakes, the capture and the digestion of preys require foraging effort and precise thermoregulation that entail significant exposure to predators. Therefore, we expect that regulations influence the decision to hold in the stomach a prey recently acquired versus to get rid off it via regurgitation (trade-off between costs and benefits to resume digestion). In snakes, regurgitation can be provoked by natural factors, low ambient temperatures or diseases for instance, or can be the consequence of handling (stress). However, the causes for regurgitation have not been studied accurately. We manipulated the feeding status, the thermal ambiance, the occurrence of a shelter, and the level of stress (simulation of an attack by a predator) in *Vipera aspis*. As expected our results showed that low ambient temperature stimulate regurgitation. They also revealed for the first time that the presence of a shelter, the level of stress, and an interaction between these two factors are crucial. These results enable to understand why unfed snakes tend to maintain high body temperatures when no shelter is available, but remain under cold shelter when available. They also reinforce the notion that even small open-areas in natural habitats can constitute serious obstacles to snakes. Conservation plans should integrate the importance of shelters, both in captivity and for field managements.

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*Notes*

Poster 107**The effect of personality on collective decision-making  
in sheep foraging on patchy environments**Michelena Pablo<sup>1</sup>, Jeanson Raphaël<sup>1</sup>, Deneubourg Jean-louis<sup>2</sup>, Sibbald Angela<sup>3</sup><sup>1</sup>Centre de Recherches sur la Cognition Animale, Bât 4R3, Salle 318, Université Paul Sabatier - Toulouse III, 118 route de Narbonne, F-31 062 Toulouse cedex 4,<sup>2</sup>Ecologie Sociale - CP 231, Université Libre de Bruxelles (ULB), Campus Plaine, Boulevard du Triomphe, Batiment NO, niveau 5, B-1050 Bruxelles Belgique,<sup>3</sup>Macaulay Institute, Craigiebuckler, Aberdeen, AB15 8QH, UK,

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Group cohesion in Blackface sheep foraging in patchy environments was studied experimentally for different group sizes of different personality types. Shy sheep and bold sheep were identified from an indoor exploration test, in which bold individuals showed a greater propensity to move away from conspecifics. Groups of 2, 4, 6 or 8 bold or shy sheep were introduced successively into 45 x 5m grass arenas, with one 5 x 5m patch of preferred vegetation at each end, during 30 minutes. The smallest groups grazed together on the same patch, but there was an increasing likelihood of splitting into subgroups with group size, with equal-sized subgroups most commonly grazing the two patches simultaneously. Bold sheep split into subgroups at smaller group sizes than shy sheep. Changes in the number of sheep located on the patches and the background were fitted by a Markov chain model. The individual probability of leaving a patch or the background decreases with the number of sheep. The individual decision-making rules were implemented in a individual agent based model in which the only difference between shy and bold sheep relies on the relation between the probability of entering a patch and the number of sheep on that patch. This study provides new insights into the mechanisms by which group-living herbivores distribute themselves across patchy resources and demonstrates the importance of interindividual variability for understanding spatial organisation at the level of the group.

Poster 108**Eurasian Siskin and Greenfinch as a model species for recognition and categorization of predators in cage experiments.**

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Great deal of experiments focused on recognition and categorization of predators are done with Tits (Parus spp.). For many reasons, Tits are favorite model group of behavioral ecology. The question is if they represent optimal choice for study of categorization predators. Tits move in a dense vegetation, that give them protection against predators. That is why presence of predators could have small impact on their behaviour. But from this behaviour we make conclusions about their ability to recognize predators. We also presume about dangerousness of predators on the base of the behaviour. A bigger reason to antipredator behavior in presence of predators could have Eurasian Siskin and Greenfinch that fly in bigger flocks in open areas but no antipredator experiment were done with them.

We compared behaviour of Great Tit (Parus major), Eurasian Siskin (Carduelis spinus) and Greenfinch (Carduelis chloris). We tested them in a presence of stuffed and 2D projected Sparrow Hawk (Accipiter nisus). Sparrow Hawk is specialist for hunting birds these size. Experiments took place in a laboratory cage of size 2 x 1 x 0,5 meter.

Eurasian Siskin and Greenfinch showed nearly no antipredator behavior in a cage experiment therefore represent unsuitable species for this kind of research.

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*Notes*

Poster 109**Do Keas (*Nestor notabilis*) plan before starting to solve  
an artificial-fruit box with multiple locks?**Miyata Hiromitsu<sup>1</sup>, Gajdon Gyula<sup>2</sup>, Huber Ludwig<sup>3</sup>, Fujita Kazuo<sup>4</sup><sup>1</sup>Department of Psychology, Kyoto University; Japan Society for the Promotion of Science, <sup>2</sup>Department of Neurobiology and Cognition Research, University of Vienna; Konrad Lorenz Institute for Ethology, Austrian Academy of Sciences,<sup>3</sup>Department of Neurobiology and Cognition Research, University of Vienna,<sup>4</sup>Department of Psychology, Kyoto University,

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Planning, the internal process of formulating an organized method about one's own future behavior (e.g., Mushiake, 2001), should be advantageous for non-human species as well as for humans. In the avian taxa, although planning has been shown in corvids (e.g., Emery & Clayton, 2004) and pigeons (Miyata & Fujita, 2008), much less is known about planning processes compared to primates. We examined whether Keas (*Nestor notabilis*), New Zealand parrots, would plan the solution of a problem before starting to solve it. We presented seven Keas with an artificial-fruit box that has multiple locks that they had to remove before obtaining reward inside. After training the birds to remove a pole from a transparent square-shaped lid, we presented them with 2-3 identical locks. In one of the locks, the pole was extended over the lid, which required a manipulation to remove it. In the other lock(s), the pole was extended in the opposite direction of the lid and required no manipulation. We also introduced a preview phase by placing a board, either opaque (i.e., without-preview) or transparent (i.e., with-preview), over the locks for 10-30 seconds before the Keas were allowed to solve the task. Our results from four tests showed that, although the birds became efficient in choosing the correct lock as they went on to further phases, the preview phase did not facilitate the birds' solution on the task. This might reflect the species' trend to solve problems in non-planful manners.

Poster 110**The effect of urban environmental noise on great tit song**

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Bird song has a fundamental role in both mate attraction and territory defence. The increase of urban environmental noise has significant implications for avian communication as it necessitates a change in signalling to avoid acoustic competition. A recent European study on great tit *Parus major* song has shown inner city birds sing shorter, faster songs with a higher minimum frequency than forest birds from the same country. To further this line of research, this study investigated the presence of these environmentally induced changes in Britain. It was carried out over the few kilometres from the centre to the outskirts of a sample of cities. Playback experiments of rural, urban and manipulated songs were used to explore the extent of responses from territorial males at both end of the spectrum. A difference in response would indicate divergence of the two groups by interruption of the signalling system.

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*Notes*

Poster 111

**Morphological variation between territorial vs. flock-feeding  
*Zenaida* doves, *Zenaida aurita*:  
Evidence for resource polymorphism?**

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How spatial and temporal heterogeneity in the environment can influence phenotypic expression is a key question in evolutionary ecology. Resource polymorphisms can be expressed in various ways, particularly through intra-specific morphological and behavioural variation. We revisited the evidence for resource polymorphism in the *Zenaida* dove, *Zenaida aurita aurita*. In this socially monogamous species, pairs typically hold territory that they defend year round against conspecific intruders. However, in Barbados, part of the population gathers at grain storage facilities where they form large, monospecific foraging flocks. Sol et al. (2005, *Ecology* 86: 2397-2407) reported significant morphological variation between one area where birds hold territories and one area where birds feed in flocks, and concluded to the existence of a resource polymorphism in the Barbados population of *Zenaida* doves. However, their study was limited by the lack of replications and inaccurate determination of sex. Here we assess the level of morphological differentiation between birds holding territories and birds feeding in flocks from data collected on four different areas over two consecutive years, and using molecular markers for sex identification. We discuss the evidence for resource polymorphism vs. ontogenetic change in foraging strategy.

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*Notes*

Poster 112**Impacts of environmental warming on stickleback predation behaviour**

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Environmental warming is extremely important in freshwater ecosystems due to the temperature sensitive nature of its ectothermic inhabitants. The three-spined stickleback *Gasterosteus aculeatus* (L.) is a voracious predator with the ability to significantly alter its prey populations through selective predation. This has ecosystem wide consequences. Being ectothermic, its metabolism and therefore rates of search and handling times for prey are temperature-dependent. Alteration of these rates will have consequences for profitability of prey items. Presented here are the results from ongoing laboratory experiments examining stickleback predation on a number of invertebrate species at local summer temperatures (18, 22 and 24 C.) The results, to date, show changes in search and handling rates with increasing temperature. Current experiments are testing predictions of temperature induced changes in optimal diet based upon temperature-dependent changes in prey profitability. The findings will be discussed with reference to the potential that climate change has to alter ecosystem structure and function by acting upon the behavioural interactions of species.

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Poster 113**The role of distance calls in parent-offspring recognition  
in zebra finches**

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The importance of zebra finches' songs (*Taeniopygia guttata*) has been shown in various contexts such as mate choice, mate recognition and intraspecific competition. However, despite their importance in the repertoire of this bird, calls have been given little attention in comparison. In non-singing birds (like seabirds for instance), calls have an important function of recognition and localization of kins and conspecifics. Here we show that zebra finches' fledglings also use distance calls to discriminate their parents among other adults, responding faster and at a higher rate to their parents than to familiar birds breeding in the vicinity. This recognition is still present at two months of age, despite the fact that parents are not feeding the young anymore. At this age, parents also use the developing distance calls of their young to discriminate them from other same aged juveniles. Interestingly, fledglings of any age generally react more to their father than to their mother, indicating a preference toward the male parent that may be linked to a stronger individual signature inside male calls. Inside the brood, first hatched chicks seem to react less to their mother than second hatched chicks, a finding consistent with the fact that females seem to feed the younger chicks more than the elder ones. We will also discuss the role of the different type of fledglings' calls in terms of recognition and localization.

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Poster 114**Avian community structure and maintenance of color polymorphism  
in an aposematic Wood Tiger moth (*Parasemia plantaginis*)**

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Prey individuals often advertise their unprofitability to predators with warning signals. Prey may show their unpalatability, noxiousness or even toxicity with conspicuous bright coloration. This phenomenon is called aposematism. Warning signals are expected to evolve towards monomorphism as the benefits to a prey individual increase as a function of the number of individuals displaying the signal. However, polymorphism in warning signals is common. One an example is the color variation in aposematic Wood Tiger moths (*Parasemia plantaginis*). Males have two distinct hind wing color patterns with either yellow or white pigmentation. We investigated the frequencies of these two morphotypes in several geographically distinct populations in Estonia, Åland and Finland. We also conducted a predation experiment by pinning dead male moths of both morphs to natural vegetation and followed their “mortality”. The local avian fauna was investigated and bird behavior toward moths of different wing coloration was observed. Results will be discussed in the light of aposematism theory and the maintenance of polymorphism in warning signals.

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*Notes*

Poster 115**The functional differentiation in groups of ants attending aphid colonies**

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The comparative analysis of the schemes of ant-aphid interactions in multi-species communities has revealed that the depth of functional differentiation in groups of ants tending separate aphid colonies (milkers) is caused by the requirements of an ant colony for carbohydrate food. The most complicated interaction (professional specialization in groups of milkers) was observed for ants with numerous colonies (*Formica* s. str.) dominating in multi-species ant communities. It is characterised by the clear division of two main functions (honeydew collecting and protection of aphids) in constant ant teams. The largest number of professional groups (shepherds, guards, scouts and transporters) was noted only for red wood ants. Other members of ant communities demonstrate simpler schemes based on a partial division of labour or individual foraging by unspecialized milkers. However, insufficient carbohydrate food resources were found experimentally to lead to reorganisation of the milkers' work and appearance of constant protection of the aphid colonies. On the whole, specialization in the working groups seems to be facultative. A tendency for the functional differentiation in the ant teams to deepen is observed as the ant colony numbers increase and also as a consequence of insufficient food resource at both intra- and interspecies levels. The study was funded by RFBR (No 06-04-48288), President of RF (Scientific School).

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*Notes*

Poster 116

**Interspecific competition between two game species: white-tailed deer (*Odocoileus virginianus* Zimmermann 1780) and red deer (*Cervus elaphus* Linnaeus 1758) in northeast of Mexico**

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The present study was carried out in Los Ebanos Game Estate (Tamaulipas, Mexico), from summer 2003 to spring 2004. We assessed the food availability and the interspecific competition of 2 game species: white-tailed deer (WTD) and red deer (RD). The study area presented 46 species of plants, distributed in four vegetation types (dune vegetation, halophyte vegetation, thorny scrub and piedmont scrub). The production of biomass was calculated by Adelaide method showing in summer, total biomass production was 1.6 t/ha, 1.5 t/ha in autumn, 2.1 t/ha in winter and 0.9 t/ha in spring. The great biomass increase in winter responded to exceptionally high precipitation rates. WTD and RD required 2.6 and 7.6 ha/yr to meet the minimum requirements for the individual survival (carrying capacity). Diet composition was assessed from faeces using microhistology, and the WTD showed preferences of 2.1% for the arboreal stratum, 42.9% for shrubs, 36.5% for the herbaceous stratum and 18.5% for gramineous. RD showed preferences of 9.4% for shrubs, 43.9% for herbaceous stratum and 46.7% for gramineous. Two seasons showed a critical diet overlap of interspecific competition: winter (43%) and spring (54%). The other two seasons had a medium-low diets similarity: summer with 39% and autumn 33%. The statistical analysis showed a high level of diet competition in spring (R: 0.76). Therefore we conclude that there is a high level of diet competition as reserved by overlap between this two game species.

Poster 117**Breeding with a mouth full of eggs**

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Mouthbrooding occurs among several groups of fishes. Although a mouth full of eggs can be expected to pose a considerable respiratory problem, no study has examined the possible respiratory consequences of mouthbrooding in fish, or how hypoxia or strenuous swimming may affect mouthbrooding. This study was carried out at Lizard Island on the Great Barrier Reef. Using closed respirometry, we found that mouthbrooding significantly reduced the ability of two species of cardinalfish (*Apogon fragilis* and *A. leptacanthus*) to take up oxygen at low ambient oxygen levels. While the direct energetic cost of mouthbrooding appeared insignificant at rest in well oxygenated water, mouthbrooding significantly reduced the respiratory scope of the fish and the capacity for sustained aerobic swimming. The males spat their eggs in hypoxia. Interestingly, the species with the largest brood, *A. fragilis*, spat out the brood at a higher water [O<sub>2</sub>] than *A. leptacanthus*, which had a smaller mean brood mass. Moreover, in contrast to *A. leptacanthus*, *A. fragilis* was unable to increase its ventilatory frequency in response to hypoxia. This suggests a trade-off situation between hypoxia tolerance and brood size. Apparently, *A. fragilis* has sacrificed hypoxia tolerance for a large brood size to a greater extent than *A. leptacanthus*.

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Poster 118**The effect of season on the evolution of dispersal**

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Dispersal is a fundamental process for the persistence of many species, but up until now there has only been limited study concerning the effect of season on dispersal behaviour. A dynamic programming model is formulated to find the evolutionarily stable dispersal strategy for a single species metapopulation over a season. Four distinct phases are found during a season at ESS: (1) no dispersal, (2) low dispersal rate, (3) high dispersal rate, and (4) no dispersal. Possible explanations for this behaviour are put forward. It is found that these seasonal phases are robust with a large range of parameters and also when complex patch quality dynamics and inhomogeneous environments are included. It is found that the time of season is the overriding factor in determining the ESS, implying that seasonality may play a greater role in the evolution of dispersal than previously thought.

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*Notes*

Poster 119

**Does a differential investment in host and food searching promote  
the coexistence of competing parasitoids?  
An evolutionary dynamics modelling approach.**

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Species specializations for different ecological functions, i.e. interspecific trade-offs, have often been proposed as a central mechanism promoting species coexistence. Yet, few studies focused on the trade-off between current and future reproduction which is decisive for animal's reproductive success. In parasitoids, this trade-off relies on a choice between host and food foraging, which allows gaining immediate and future fitness, respectively. We investigated, from a theoretical perspective, if any differential investment in host and food foraging would facilitate the coexistence of competitive parasitoid species. We considered a host-parasitoid system in which parasitoids split their time between host and food foraging. We then looked at the evolutionary dynamics of the system, by considering that a rare mutant devoting a different part of its time to feeding arises in the population. Our results reveal that the adaptive strategies differ according to the rate at which feeding enhance survival. When feeding for a short time is sufficient to enhance survival, the only stable strategy would be to split time between host and food foraging. On the other hand, when parasitoids have to feed for quite a long time to enhance their survival, two distinct stable strategies arise: to forage for hosts only, i.e. to maximize early lifetime reproductive output, and to split effort between host and food foraging, i.e. to spread less offspring but to survive longer.

Poster 120**African grey parrots (*Psittacus erithacus*) are able to categorise items spontaneously using human words.**

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Wild animals often adopt appropriate behaviour in response to a novel stimulus because the latter is similar to a familiar stimulus and to which the response is already known. Such behaviour expresses an ability to categorise. Several laboratory experiments have shown that pigeons and monkeys are able to form perceptual and sometimes functional categories like food/non-food. During a study conducted to compare methods used to teach parrots to use human words as labels, we also investigated their spontaneous categorical use of these words.

Two African grey parrots (*Psittacus erithacus*), a two-year-old male and a four-year-old female were tested with the two following methods:

-Model/Rival method: interactions between two trainers who demonstrate questions and answers in reference to an object, the parrot observes and can take part.

-Intuitive method: naming an object while the experimenter or the parrot manipulates it.

We observe spontaneous categorisation by both subjects for food versus non-food items. There is little data on spontaneous functional categorisation, since in previous studies animals are trained to categorise. Parrots tend to make an over-extension of the categorisation as children do. In our case it could be explained by the fact that it is harder for the parrot to learn, remember and produce several different words to ask for objects or food than to use one word for all the items classified in each of his categories.

Poster 121**Differences in responsiveness of male and female callitrichids  
submitted to tasks involving food acquisition**

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It has been shown that adult females of marmosets (*Callithrix*) and tamarins (*Saguinus*) demonstrate priority of access to food items and that, compared with males, females spend more time in foraging activities. However, this does not seem to be a callitrichids' general pattern, since this was not well reported to occur in *Leontopithecus*. The present study compared the responsiveness of males and females of callitrichids through discriminative tasks involving food acquisition. Five *Callithrix penicillata*, six *Leontopithecus chrysomelas* and three *Saguinus midas niger* were individually tested by a behavioural paradigm of colour discrimination learning. The number of trials per experimental session was predetermined and session's mean duration was used as criterion for responsiveness quantification. In general, males seemed to engage more frequently in vigilance behaviours, needing more time to accomplish the tasks. Results support the idea that females of callitrichids respond more persistently than males to tasks involving food acquisition. This appears to be a general pattern for callitrichids.

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*Notes*



Poster 122**Maternal effects can create variation in offspring personalities**Pihlaja Marjo<sup>1</sup>, Rokka Kaisa<sup>2</sup>, Siitari Heli<sup>2</sup><sup>1</sup>Biological and environmental sciences, P.O.Box 35, FIN-40014 University of Jyväskylä, Finland,<sup>2</sup>University of Jyväskylä, Finland,

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Why there are individual personalities and what creates variation in personality traits? For long time it was thought that variation in personalities was mainly just noise around adaptive mean. However, recently several studies have proved that personality traits may be heritable, and that personalities favored by natural selection may vary over time. In addition to selection on genes coding personality characteristics, there may be other mechanisms creating variation. We have studied how maternal effects influence offspring personality in magpies (*Pica pica*). In our previous research we found strong influence of maternal effects through egg quality and hatching asynchrony on offspring performance in the magpie. In this study we raised magpie juveniles in large outdoor aviaries in seminatural conditions over their first year of life and conducted behavioral experiments three times. We found that individuals originating from early or late hatching positions in their clutch differed continually from each other in activity in novel environments and with novel object. However, difference was more pronounced in females than males. Females in late hatching position were more active than females in early hatching positions. Activity of the individual was related to its interest to the novel object. Moreover, in females there was more variation in amount of movements. Parents may profit from producing different type of offspring if future environmental condition are unpredictable.

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*Notes*

Poster 123**Social learning strategies in nine-spined sticklebacks**

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Theoretical models used to investigate the adaptive advantages of social learning lead to the conclusion that social learning cannot be indiscriminate and that individuals should adopt evolved behavioural strategies that dictate the circumstances under which they copy others and from whom they learn. In a series of experimental studies, we provide evidence that nine-spined sticklebacks (*Pungitius pungitius*) use public information adaptively, switching to exploit a more profitable food patch if the returns to 'demonstrator' fish are greater than their own, but ignoring public information when low-profitability patches are demonstrated (in line with the putative behavioural strategies of 'copy if better' and 'copy in proportion to the demonstrators' payoff'). These findings reinforce the argument that public-information use in nine-spined sticklebacks is an adaptive specialisation. More generally, the observation that this sophisticated form of learning is observed in a species of fish supports the view that enhanced social learning may be better predicted by specific selective agents than relatedness to humans.

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*Notes*

Poster 124

**Environmental mediation of intraguild predation  
between the amphipod invader *Gammarus pulex*  
and the native *Gammarus duebeni celticus*.**

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Invasive species and environmental change often occur simultaneously across a habitat, therefore our understanding of their relative roles in the decline of native species is often poor. Here, we examine the environmental mediation of a critical inter-specific interaction, intraguild predation (IGP), between invasive (*Gammarus pulex*) and native (*G. d. celticus*) freshwater amphipods. In the laboratory, we examined IGP asymmetries (males preying on congeneric females and precopulae) in river water from zones where: (1) the invader completely displaces the native; (2) the two species co-exist, and (3) the native persists long-term. The invader was always a more effective IGP predator, but this asymmetry was significantly weaker as we moved from 'invader water' through 'co-existence water' to 'native water'. We did not identify the constituent of the water that drives this mediation of IGP. However, balancing the rigour of laboratory experiments with field derived 'environment' has significantly advanced our understanding of known patterns in a native species decline, co-existence and persistence in the face of an invader.

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*Notes*

Poster 125**Cage experiments – a potentiality to study predator recognition in birds?**

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Ability to recognize and evaluate dangerousness of predators by birds is largely study by mobbing experiments taking advantage of parent's effort to protect nest with eggs or young. On the contrary, general ability of birds' discrimination and categorization is almost exclusively study in lab experiments based on learning which enable high level of formalization because it is possible to focus on only one feature (color, size, etc.).

We decided to combine both approach. We study Great Tit (*Parus major*) and its ability to recognize its predator, Sparrowhawk (*Accipiter nisus*) in a cage experiment. It is known that Great Tit is able to recognize models of this predator in natural conditions. We demonstrated Sparrowhawk in different ways – as stuffed one, carved one and photo one projected on plasma monitor. All models were in life-size. A measurement of the cage was 2 x 1 x 0,5 m. There were some branches for sitting and nesting box for hiding in the cage. Great Tit starved for 1,5 hour before the experiment. During the experiment, seeds of sunflower were deposited in front of predator.

Great Tits behaved stressfully in the presence of stuffed as well as carved Sparrowhawk so these kinds of models could be recommended for categorization experiments. In the presence of photo reacted only a smaller part of birds so in the case of using plasma monitor is needed to include learning phase.

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*Notes*

Poster 126**How parasite-mediated nutritional responses alter the relationship between host longevity and fecundity?**

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*Tenebrio molitor* is an intermediate host of the rat tapeworm, *Hymenolepis diminuta*. Despite the costs associated with parasite invasion, there is an overall highly significant difference in survival time between infected and control populations of beetles, the extension of the host lifespan providing more opportunities for parasite transmission. The infection, has, nevertheless a pronounced negative effect on the host reproductive output. In the present work, this parasite-induced increase in host longevity is discussed in the light of changes in host diet selection. We report the use of recent advances in nutritional research to quantify the detailed relationship between diet, nutrient intake, lifespan, and reproduction in infected beetles. The manner in which the diet selection and nutrient intake by parasitized beetles differs from that of normal non-parasitized insects was determined.

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*Notes*

Poster 127**Leaving the crowd: the dynamics of behavioural phase polyphenism in marching locusts**Popple Julie-Anne M.<sup>1</sup>, Sword Gregory A.<sup>2</sup>, Simpson Stephen J.<sup>1</sup><sup>1</sup>School of Biological Sciences, Heydon-Laurence Building, The University of Sydney, NSW, 2006,<sup>2</sup>School of Biological Sciences, Macleay Building, The University of Sydney, NSW, 2006,

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Behavioural phase polyphenism (BPP) is a form of density dependent phenotypic plasticity that produces non-migratory “solitarious” phase locusts at low population densities and swarm-forming “gregarious” phase locusts at high population densities. The gregarious phase is characterized by high activity levels and an attraction toward conspecifics, whereas the converse is true for the solitarious phase. The Australian plague locust, *Chortoicetes terminifera*, is a major agricultural pest. In the field, gregarious juvenile locusts form bands with a very distinct structure characterized by extreme density gradients, with density towards the back of the band falling so low that locusts may change their phase and become “solitarious”. We have developed a modified behavioural assay and studied the dynamics and time course of BPP in a locust band. The behaviour of locusts from the dense part of the band and stragglers from the back of the band was quantified on the first day of sampling and at intervals of 24 and 48 hours. We kept nymphs in isolated or crowded conditions to provide “solitarious” and “gregarious” controls for the behavioural assays. Our results show that locusts begin to solitarise on the periphery of bands where they become isolated. This is the first evidence of a phase change in the wake of bands and provides new insight into the dynamics of BPP in natural populations, which is critical for improved prediction and control of locust outbreaks.

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*Notes*

Poster 128**Sex roles in Great Reed Warbler nest defence against a brood parasite**Pozgayova Milica<sup>1</sup>, Prochazka Petr<sup>2</sup>, Honza Marcel<sup>2</sup><sup>1</sup>Institute of Vertebrate Biology AS CR, v.v.i., Kvetna 8, CZ-60365 Brno, Czech Republic; Institute of Botany and Zoology, Kotlarska 2, CZ-61137 Brno, Czech Republic,<sup>2</sup>Institute of Vertebrate Biology AS CR, v.v.i., Kvetna 8, CZ-60365 Brno, Czech Republic,

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As brood parasitism is detrimental to host reproductive output, both parents should evolve aggressive mobbing and nest guarding to prevent parasitic laying. Participation in egg ejection, on the other hand, is thought to depend on the incubation effort of each mate. In this study we explored how the sexes of the Great Reed Warbler (*Acrocephalus arundinaceus*) share the three main components of defence behaviour against a brood parasite, the Cuckoo (*Cuculus canorus*). Because only the female incubates the clutch in this host, she is expected to accomplish egg ejection. The male, however, frequently visits the nest to feed his mate, thus, he also may be involved in egg ejection. To investigate this, we filmed behaviour of colour-ringed Great Reed Warblers before and after a Cuckoo dummy presentation, and after experimental parasitism. The male played a key role in Cuckoo repelling and significantly increased his nest guarding after Cuckoo disappearance. On the contrary, the female was the sex responsible for checking the nest contents and egg ejection. Our study revealed sexually specific egg-ejection behaviour in this host and adoption of different sex roles in nest defence against a brood parasite. (Funded GAAV A600930605, GA&#268;R 524/05/H536.)

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Poster 129**Human-Nature Systems in the cities: feral pigeons as a case study**

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Global urbanization participates to the growing human footprint. The different kinds of nature present in European cities (e.g. domesticated, gardened, feral, wild) raise the question of the coexistence of human and natural systems in the urban context.

Feral pigeons (*Columba livia*) is a fascinating example of diverse urban representations and practices: ignored by scientists because of its feral status, it has an important history of cohabitation with humans (domesticated pigeons for food or races, homing military pigeons, pigeons as a symbol of peace...). Urban pigeons are now managed by local authorities, in order to decrease populations, assumed to be growing and too numerous.

The interdisciplinary research program “urban pigeons” (6 laboratories) aims to understand the social-ecological system around this species, with three main axes:

- (i) Studying the biology of urban pigeons (population dynamics and genetics, public information according to breeding and feeding resources, parasite transmission...)
- (ii) Studying the various representations and uses of urban actors according to pigeons (feeders, urbanists, city dwellers, managers...)
- (iii) Understanding the various policies and management strategies, both at social and biological level (capture and euthanasia, dovecotes...)

The applied objective of this program is to help managers and local authorities to find sustainable solutions to the “pigeon problem”, and more generally to the coexistence between urban nature and human.



Poster 130**Group movements in redfronted lemurs (*Eulemur fulvus rufus*)**

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Group living is beneficial to the individual in many ways (i.e., increased vigilance, division of labor), but there are also conflicts of interest between the single group members. To maintain group cohesion, activities and movements of group members have to be coordinated. Spatial movements of a group represent an excellent model to study the fundamental social processes and mechanisms involved in group coordination. The objective of this study was to analyze the patterns, processes, mechanisms and decision types underlying group movements of cathemeral redfronted lemurs (*Eulemur fulvus rufus*, Lemuridae) in Kirindy Forest, Western Madagascar. Using behavioral observations, video and sound recordings, we quantified movements of five groups of redfronted lemurs day and night. Additionally, phenological data were collected to examine the possible influence of environmental, social and intrinsic factors on group movements. Preliminary results revealed that both females and males led group movements, but females did so more often and more successfully. There was no sex-specific difference in the number of followers and in the distances covered with group movements, however. This study of a species without sex-specific dominance patterns and with activity during both day and night can contribute important comparative information to elucidate the control of group movements in primates and other non-anonymous groups.

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*Notes*

Poster 131**Flehmen and social dominance  
in captive male Indian Blackbuck, *Antelope cervicapra* L.**Rajagopal Thangavel<sup>1</sup>, Sekar M.<sup>2</sup>, Archunan G.<sup>1</sup><sup>1</sup>Department of Animal Science, Bharathidasan University, Tiruchirappalli-620 024, Tamil Nadu, India,<sup>2</sup>Biologist, Tamil Nadu Forest Department, Arignar Anna Zoological Park, Vandalur, Chennai-600 048, Tamil Nadu, India,

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The Flehmen or lip-curl behaviour displayed by most ungulate species is a sexually dimorphic behaviour seems more frequently when males investigate either female or male urine. Functionally, Flehmen refers to the transport of non-volatile chemosensory materials from the oral cavity to vomeronasal organ (VNO). The relationship between male dominance and flehmen was investigated in a herd of 23 male blackbuck at the Agrinar Anna Zoological Park. All occurrences of Flehmen by adult males were recorded during 240 hrs of observation over 5 months. The Flehmen frequencies were correlated with rank, which revealed that the dominant male exhibited the highest Flehmen rates when compared to subordinates. By contrast, subordinates rarely performed Flehmen in response to females urine. During sniffing and licking of female urine by the subordinate males, the dominant male immediately agonistic contact between subordinate, and preceded opportunity for Flehmen. Interestingly the dominant naturally performed Flehmen while subordinate never did. Self-enurination was frequently observed in subordinate as compared to dominant male, which involves a male performing the behaviour in response to his own urine. The present work conclusively demonstrated that the occurrence of Flehmen may synchronization of reproduction by enabling dominant to assess other reproductive conditions. High-ranking dominant showed the greatest degree of reproductive synchrony within a herd.

Poster 132**Maternal care in a highly precocial mammal**

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1) We tested predictions on parent-offspring interactions derived from experiments in altricial mammals and from models referring to altricial birds in a highly precocial mammal where young can feed themselves while still being nursed. We cross-fostered guinea pig pups, *Cavia aperea* f. *porcellus* = GP with caviae, *Cavia aperea* = C. GPs are heavier, produce more milk and wean later. We thus created a low supply for pups with Cmothers and a high supply for pups with GPmothers. Females with Cpups confront low demand, those with GPpups high demand. Unlike findings in altricials, pups confronting high supply begged more frequently. We suggest that benefits of begging in relation to benefits of self-feeding determine the decision to beg. High demand GPpups begged more and mothers nursed more frequently. In contrast to altricials, mothers did not adjust milk production and weaning time. Thus, cross-fostered GPpups were weaned earlier and cross-fostered Cpups benefited from more milk and longer lactation than under normal conditions.

2) Concurrent pregnancy and lactation (CPL) is common in small altricial mammals. Reduced lactation during CPL has been interpreted as a result of energetic allocation conflicts. We studied the effects of CPL in GPs, where in contrast to altricials energetic peaks of both phases do not coincide. CPLmothers nursed less and weaned earlier than non-pregnant mothers. As energetic constraints are unlikely we suggest our results must be explained by regulatory constraints.

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Poster 133**Distance-dependent geographic variation in great tit songs  
in a fragmented habitat**

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Intraspecific acoustic variation can lead to reproductive isolation through female preferences for local songs or song-dependent ability of males to establish and maintain a territory. Acoustic divergence among subpopulations could emerge rapidly and over short distances especially in fragmented landscapes. We studied song variation in the great tit (*Parus major*) at a micro-geographic scale in nine forest fragments of variable size. We analysed song repertoire sharing and acoustic similarity among individuals with a known dispersal history. A general decrease with distance was found for both repertoire sharing and acoustic structure of common song types. The acoustic divergence correlated well with dispersal data. Moreover, immigrant birds shared less song types with neighbours than locally born birds did. These results suggest that geographic variation in song could provide great tits with cues about male dispersal distance. We also found an increase in repertoire similarity with an increase in fragment size. So, fragmentation leads to increased local convergence and is likely to make gradual acoustic gradients more discrete and maybe easier to detect. Discrimination ability among songs of immigrants and locals could affect female preferences and male territorial response strength. As a consequence song variation has the potential to contribute to a reduction in gene flow among populations, and this process may be accelerated by habitat fragmentation.

Poster 134**Environmental conditions and maternal effects**

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Unpredictable, poor environmental conditions can induce a change in the normal hormonal state of an animal and, in some species, this transition may be accompanied by elevated concentrations of the stress hormones (corticosterone/CORT in birds). These changes can result in various behavioural responses, including alterations in reproductive investment, depending on the severity of the situation. It has previously been shown that elevated maternal blood concentrations of CORT can result in elevated deposition of CORT in egg yolk, where it can impact on the development of the embryo. Herring gulls (*Larus argentatus*) and lesser black-backed gulls (*Larus fuscus*) are closely related species that breed in overlapping colonies in both coastal zones and urban areas. Over the last three decades, non-urban herring gull numbers have declined in Britain and Ireland, while the lesser black-backed gull numbers have remained stable or increased. In addition, both species have exhibited increased utilisation of the urban environment, where breeding success can be higher than in the wild. We have investigated if there is a physiological difference between these two species in their maternally derived CORT, which may explain the different population trends, and if the urban habitats provide a less stressful environment over the non-urban habitats.

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Poster 135**Social conflict among pathogens and its effects on virulence**

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Bacteria, whether free-living, commensal, or pathogenic, communicate, coordinate and cooperate with one another extensively. They share nutrients, build protective structures, and produce a broad range of exoproducts that benefit the population by processing food, killing competitors or overcoming host defences. However, any form of cooperation is vulnerable to exploitation, and can collapse without mechanisms to keep cheats in check. In a series of in vivo experiments, we studied the effects of social conflict within infecting populations of the opportunistic pathogen, *Pseudomonas aeruginosa*. As model hosts, we used plants, insects and worms, and as cheats, we used bacterial strains defective for (a) the production of a key exoproduct (siderophores) or (b) a mechanism of communication and coordination (quorum sensing). Within infecting populations, cheats occasionally achieved higher relative fitness than cooperators, yet their presence was detrimental to population productivity, which was reflected in reduced virulence. Social conflict among pathogens can thus reduce the virulence of an infection

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*Notes*

Poster 136**Plasticity of activity patterns under conditions of coexistence  
in a rodent community**

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Daily rhythms of mammals are regulated by an internal clock, the SCN which has an endogenous rhythm. This rhythm is adapted to the day by the change of light intensity, but beyond it nonphotic zeitgeber or synchronizers have an impact concerning an optimizing of the survival and reproductive fitness of animals. Therefore an optimal timing of behavior and physiology is promoted with respect to a mixture of biotic and abiotic factors.

The aim of our study was and is to investigate the physiological background of the plasticity of the time axis use. The model-species used are the Desert hamster (*Phodopus roborovskii*) and the Mongolian gerbil (*Meriones unguiculatus*). Both live sympatrically in semi-deserts of Mongolia and Northern China and show a different interspecific behaviour. While gerbils appear as more aggressive versus intruders, hamsters act shyly.

In this laboratory study conditions and periods of contact between both species were created and the length of the contact-periods was varied. Now changes in the circadian rhythm of the subordinate hamsters were analyzed. Key elements were the stability of rhythm, i.e. the determinations of phase shifts in phase response curves (PRC) and changes in the activity pattern. A further aspect deals with the perception and transmission of stimuli, that means the kind of stimulus was varied; a contact between animals was realized via a contact bar or only the odour was presented with and without earlier contact between both species.

Poster 137**The RFID technique: a new research tool  
to investigate social behaviour in mammals**

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Observation of movements of animals in a complex environment, even under laboratory conditions, has always been a challenge in the study of behaviour. Video recording has been used to this purpose but automation, even with modern techniques based on digital image analyse, remains difficult to implement when several animals are concerned. By contrast, Radio-Frequency Identification (RFID) is an innovating technique which allows to record automatically in real time and during a long period the localisation of each animal. Each individual is identified by an electronic label, named tag or transponder, which is directly implanted in animals by sub-cutaneous injection. The glass tag is small and contains no battery. A magnetic antenna detects the passage of each tag. This antenna is connected to a computer through an electronic device, and every detection is recorded in a TXT file. There is no limitation in the number of tags (individuals or objects) or in the duration of the recording. As an illustration we present an experiment on the division of labour in mound-building mice during the construction of the autumnal mound. Six individuals were placed in the experimental device and cotton balls were used as building materials. Each individual and each cotton ball were identified by a tag. The activity of the mice was recorded for a ten day period. Our results revealed that only two or three mice were involved in the collection of cotton balls.

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Poster 138**Sperm competition in farmed and wild cod**

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The rapid development of cod aquaculture has raised concerns about how this industry will affect local coastal cod. One area of concern is that escapees may hybridise with wild cod, causing genetic introgression, which can cause fitness depressions in wild populations. The risk of hybridisation will depend on the escapees overall performance in mating competition with wild cod.

Sperm traits will clearly influence males' reproductive success. We therefore analysed sperm velocity, percentage of motile cells and spermatocrit of wild and farmed males at the onset and the end of the spawning season. Wild and farmed males were also paired in in vitro crosses. Wild males had higher sperm velocity, percentage of motile and progressive cells and spermatocrit values at the start of the spawning season. The in vitro crosses showed that sperm velocity was positively correlated to fertilization success and concurrent with their faster sperm, wild males had higher fertilization success. At the end of the spawning season there was no difference between males in percentage motile or progressive cells or spermatocrit, but wild males still maintained a higher sperm velocity.

Our results indicate that farmed males have limited reproductive success in sperm competition with wild cod. This likely reduces the risk of hybridisation between male escapees and wild females. Lack of social structure in fish farms or nutritional deficiencies might cause these differences between wild and farmed cod.

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*Notes*

Poster 139**The cleaning goby mutualism: a system without punishment,  
partner switching or tactile stimulation**Soares Marta C.<sup>1</sup>, Côté Isabelle M.<sup>2</sup>, Cardoso Sónia C.<sup>3</sup>, Bshary Redouan<sup>4</sup><sup>1</sup>Unidade de Investigação em Eco-Etologia, Instituto Superior de Psicologia Aplicada, Portugal and Institut de Zoologie, Eco-Ethologie, Université de Neuchâtel, Neuchâtel, Switzerland,<sup>2</sup>Department of Biological Sciences, Simon Fraser University, Burnaby, Canada,<sup>3</sup>School of Biological Sciences, University of East Anglia, Norwich, UK,<sup>4</sup>Institut de Zoologie, Eco-Ethologie, Université de Neuchâtel, Neuchâtel, Switzerland,

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In the cleanerfish-client mutualism involving the Indo-Pacific cleaner wrasses *Labroides dimidiatus* and its reef fish clients, mechanisms such as ‘tactile stimulation’, partner switching and punishment are used by clients to control cheating by cleaners. We sought to establish whether these behaviours are general features of cleaning mutualisms by examining their presence in interactions between Caribbean cleaning gobies (*Elacatinus* spp) and their clients. The cleaning goby-client mutualism bears several similarities to the cleaner wrasse system: clients visit cleaners frequently to have their ectoparasites removed while cleaners depend heavily on these visits for food while cheating by cleaning gobies is also prevalent. However, our data revealed striking differences between the two cleanerfish systems: clients did not seem to attempt to control cheating and also, cleaning gobies did not perform tactile stimulation on their clients. We suggest three hypotheses that might explain these major differences between both systems, based on differences in mutual dependence between cleaners and clients or cognitive ability of cleaners, differences in costs of being cheated, and differences in foraging preferences by cleaners. Interactions between *L. dimidiatus* and its clients should probably not be seen as the “standard” marine fish cleaning mutualism.

Poster 140**C-fos activation in sea bass (*Dicentrarchus labrax*) brain  
consecutive to a social stimulation**

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What are the neural structures implied in social stimulation in fish? We try to give an insight by measuring c-fos activation in brains of sea bass (*Dicentrarchus labrax*) placed in particular social contexts. Two groups of 20 fish were reared in two independent tanks during one month. Two types of pair were formed: pairs of unfamiliar fish (one fish from each tank) and pairs of familiar fish (two fish from the same tank). Such design led to aggressive interactions (unfamiliar pairs) or congener recognition (familiar pairs). A third group consisted in isolated fish (no interactions with congeners). Brains were removed after 1h30 of interaction and c-fos expression was investigated in the whole brain by immunocytochemistry. Ethological analysis was performed too, allowing to measure approach, intimidation, chasing and attack in case of aggressive and familiar interactions. Each tested unfamiliar pair formed a dominate-subordinate relationship, where the dominant fish performed most of the aggressive acts (ANOVA,  $P < 0.05$ ,  $n=8$ ). Very few or no aggressive acts were observed between individuals of familiar pairs. Unfamiliar pairs exhibited significantly more aggressive acts than familiar pairs (ANOVA,  $P < 0.05$ ,  $n=16$ ). Compared to control fish, c-fos label seemed to be more intense in olfactory lobes, pons and medulla in socially stimulated fish.

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*Notes*

Poster 141**Agonistic behaviour of workers of the red wood ant *Formica polyctena* Först. during encounters with workers of *Formica fusca* L. and *Formica cinerea* Mayr.**

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Inter-specific agonistic behaviour of workers of the red wood ant *Formica polyctena* Först. was studied by means of dyadic aggression tests in which foragers of that species were paired with foragers of *Formica cinerea* or *F. fusca*, two species closely similar in respect to worker size, but showing striking differences in ecology and behaviour. Whereas *F. fusca* live in relatively small colonies and defend only their nests, *F. cinerea* are territorial and highly aggressive and often form large polycalic colonies. The latency from the start of the test to the first aggressive physical contact between the ants was shorter in the tests with *F. cinerea* than in those with *F. fusca*. Workers of *F. polyctena* engaged in overt aggression (fights) with similar frequency in both types of tests, but during their encounters with *F. cinerea* fights occurred earlier and had longer total duration. Prolonged gripping of a *F. polyctena* worker appendage by its opponent was also more frequent in the tests with *F. cinerea*. However, worker death occurred only in one case in the tests with *F. cinerea* and never in those with *F. fusca*. In contrast to overt fighting, threats (open-mandible threats and gaster flexing) were observed more frequently and had longer total duration in the tests with *F. fusca*. Relative prevalence of threats over escalated fighting in the tests with *F. fusca* seems to be at least partly related to lower readiness of *F. fusca* to engage in aggressive encounters with *F. polyctena*.

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*Notes*

Poster 142**Offspring numbers display breed-specific sexual preferences  
among domestic chicken breeds**

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Offspring numbers can be seen as a display of individual fitness of the parent, influenced by preferences especially of the female in terms of sexual selection. One domestic chicken breed, White Crested Polish (WCP) was monitored to show specific sexual mate preferences in comparison with Lohmann Selected Leghorn Classic (LSL, 1st year) and Red Leghorn (RL, 2nd year). WCP strike with an enlarged brain and display peculiar behavioural characters. Experiments have been focused on the behaviour of the hens 1) to investigate sexual preferences of hens and 2) to analyze fertilization and hatching rates of mixed breeding groups. 50 WCP, 50 LSL and 50 RL respectively were hatched and raised up together. 1) Two cocks of both breeds were presented to one hen and the duration of stay was measured using the program Viewer (Biobserve). WCP hens stood significantly longer at cocks of their own breed, while LSL and RL showed no preferences. These preferences are reflected in the analysis of the fertilization and hatching rates which were increased in breed-internal pairings. This leads to the conclusion that domestic chicken breeds can represent an ethological and reproductive entity below the species level. Both keywords are known in the context of the Biospecies concept. Impacts on breeding systems and animal husbandry will be discussed.

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*Notes*

Poster 143**The effect of relatedness on social preference in House Sparrows**

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The consequences of kinship on affiliative behaviors have been rarely studied in non-breeding bird flocks. In this study we investigated the effect of relatedness on social preference in three mixed-sex captive flocks of wintering House Sparrows (*Passer domesticus*). We observed the 'following behavior' (i.e. joining a flock-mate that initiated a new activity) of 28 focal individuals that had same-brood siblings in their flocks, and also had closely and distantly related non-sib flock-mates (determined by genotyping all individuals at 7 polymorphic microsatellite loci). We calculated association indices from the observed following events, and tested whether kinship and individual characteristics of focal birds (such as: sex, dominance rank, brood size and body condition) affected flock-mate following behavior during social activities. We found that sparrows were more associated with their siblings than with other flock-mates. The birds' sex and brood size also had significant effects on their preference: males from larger broods and females from smaller broods joined their siblings more often, and males from larger broods also followed their closest non-sib kin frequently. Our results indicate that both relatedness and early social environment in nestling period may influence group-mate preference in House Sparrow flocks.

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*Notes*

Poster 144**Is “temperament” adjusted by environment during early ontogeny?  
The effect of incubation temperature on adult behaviour in geckos**

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In ectothermic animals, physiology, morphology as well as behaviour can be influenced by environmental factors during early ontogeny. But it is much less known whether such effects can persist to adulthood and thus affect long-term fitness.

In our study, we tested persistency of the effect of incubation temperature on consistent behavioural responses across various contexts in captive Yucatan banded geckos (*Coleonyx elegans*, Eublepharidae). The geckos were incubated at three constant temperatures with low egg mortality (26, 28, 30 °C) and reared individually under the same conditions. Adult geckos were tested during three main standardized situations: (i) in a novel environment (open-field test), (ii) after the addition of a prey to slightly food-deprived gecko and (iii) during presence of a moving object (simulated predator). Responses in all situations were highly repeatable. However, the effect of incubation temperature was found only in stressful situations (i,iii). The animals incubated at 30 °C moved generally less and showed smaller frequencies of several stereotypic behavioural elements. Indirect circumstantial evidence suggests that the differences among behavioural types induced by incubation temperature follow more likely the “proactive-reactive” axis rather than the “activity/non-activity” axis.

Our results demonstrate that thermal environment during incubation can permanently organize behavioural phenotype in reptiles.

Poster 145**Starvation supports courage in Great Tits**

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Disadvantage of outdoor experiments focused on bird's recognition and categorization of predators is a shortage of models, which is possible to try in one location, and a great influence of immediate conditions. Therefore we have tried to transfer these experimental studies laboratory conditions. From outdoor feeder experiments is obvious, that the willingness to risk in a presence of predator is affected by food saturation of tested birds.

We compared a reactions of replete and hungry (1,5 hour without feed) Great Tits (*Parus major*) to differently dangerous kinds of birds. Experiments accomplished in a cage 2x1x0,5 m, where tits had had a possibility to sit on perches and take shelter in a shrub or in a nesting box. During the experiment, food was put in to the front part of the cage (near the predator model). In front of the cage we placed stuffed models either of a birds hunting specialist - Sparrow Hawk (*Accipiter nisus*) or a nest predator – Jay (*Garrulus glandarius*) or an harmless analogous size bird – Pigeon (*Columba livia* f. *domestica*), eventually the space in front of the cage was abandoned empty, which served like a control experiment.

Hungry tits were generally more active than eaten those, all tits were afraid of Sparrow Hawk, contrarwise Pigeon didn't induce any fear. The most difference was, that replete tits often hid into the box at the beggining of the experiment and they stayed there for the rest of the experiment.

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*Notes*



Poster 146**How the birds judge the risk of predation in winter feeder experiments**

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Up to the present, the ability of birds to assess dangerousness of various predators was studied intensively in the experiments on breeding individuals defending their nests. Experiments at feeders can be another good way to study predator recognition and risk assessment. Birds have to make a decision if the risk compensates for the food intake, so the willingness of arrival to feeder expresses the risk evaluation quite exactly. We examined the response of tit species to avian predators, harmless bird species and an unfamiliar artificial object presented nearby of a feeder. Choice between feeders with more and less dangerous avian predators was studied in another experiment. The major results are: (1) Tits distinguish obligatory predators, occasionally dangerous corvids and the harmless birds. The increasing risk lowers the success of realized visits. (2) There is not significant difference between response to blank control, unfamiliar object and harmless birds. (3) The corvid evaluation did not differ in the number of arrivals from other harmless dummies but contrary to them, the significant difference from control is characteristic for it. (4) The direction of arrival on feeder is in agreement with predictions of the dynamic risk assessment theory. The tits try to have dangerous birds under permanent control. (5) Tits evaluate both predators equally dangerous in independent trials but sparrowhawk lowers the number of arrivals more than kestrel in preferential experiments.

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*Notes*

Poster 147**Sibling rivalry in black legged kittiwakes**

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In broods of several avian species asymmetries between the eggs are present. Some of these differences influence the presence of sibling rivalry although only few species show direct aggression when competing with their siblings for resources and parental care. Within clutch asymmetries in egg size, composition, time of laying/hatching could directly influence the severity and outcome of this competition. In the present work, some of the less studied factors in sibling rivalry, like egg size and egg composition were experimentally manipulated in black-legged kittiwake (*Rissa tridactyla*) chicks. Behaviour and survival of chicks hatched from experimental clutches were compared with chicks from natural broods. Chicks from experimental broods controlling for egg size and broods formed by two chicks hatched from eggs laid on the same position were more aggressive than control ones. Moreover, chicks from natural broods always survived in higher proportion than experimental ones. The stress response of manipulated chicks was compared with the stress response of control ones and no differences were found but all of them were capable of mounting a stress response at 7 days of age. These results suggest that within clutch asymmetries, are advantageous not only for the parents but for the offspring fitness.

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Poster 148**Diet learning and the role of copying:  
the interplay between self-organization and adaptation.**

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Copying other individuals is of interest as an adaptive foraging behaviour, and with respect to the evolution of cognition and cultural inheritance.

We study the adaptive significance of copying in diet learning using a rich spatial model with individuals that forage in groups.

We find that learning and behaviour interact to shape the learning process.

According to resource distributions, this interaction generates automatic patterns of experience in groups, which set the background for copying behaviour.

When automatic social influences on learning cause individuals to converge in learning, copying is redundant, or excessive.

When individuals diverge, copying helps individuals pool their experience and collectively alleviate constraints on individual learning. This process helps individuals deal with environmental change. Moreover, copying can help individuals accumulate cultural knowledge over time. This cultural storage helps them to deal with cycling environments. We obtain these results if we take into account that learning takes time.

This allows copying to become an integral part of individual learning and gives rise to collective problem solving. We conclude that the adaptive value of copying depends on underlying self-organizing processes, as structured by the environment, when behaviour and learning can interact.

Poster 149**Density of juveniles and synchronization of their first emergence influences on juvenile survival in long-teeth ground squirrel (*Spermophilus fulvus*).**

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It's assumed that living in group has cost and benefits for an animal, so living in a social vacuum and in a crowd will be equally bad for it. For example, great density of juveniles can be attractive for predators or they'll feel lack of food. We analyzed an influence of density of young long-teeth ground squirrels on their survival rate. We studied permanently marked squirrels in the wild, in Saratovskaya oblast', Russia, in 2004-2005. We determined coordinates of natal burrows by GPS and found distances between all burrows. For every litter (N=67) we found an amount of juveniles, emerged closer than 100 m and within  $\pm 2$  days from the litter emergence (include the litter). We analyzed connections of this parameter with a percentage of young, which were still alive in the litter after 2 weeks after emergence (dispersion didn't start before this time), and with amount of dead juveniles. We found that correlation between these parameters was linear: the more juveniles emerged near the litter, the smaller was percentage of survived juveniles ( $r_s = -0.33$ ,  $p = 0.006$ ) and the bigger was amount of dead juveniles in the litter ( $r_s = 0.48$ ,  $p < 0.0001$ ). Thus, the young survival rate was lower when they were surrounded by many similar juveniles, and we didn't find benefit of group living in this case. Possible, aggregations of new-emerged young were too attractive for predators (in particular, cats killed many young). (Supported by RFBR (07-04-00721), Russian Science Support Foundation).

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Poster 150**Inter-annual variation and function of melanin-based ornamentation  
in female Eurasian kestrels**

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Competition for resources is the main evolutionary explanation for conspicuous ornaments in males, although this idea is not generalised in females. Conspicuous female ornaments are suggested to be the result of a genetic correlation between sexes, a mechanism for recognition of sex or species, or due to competition for resources. We studied three different melanin-based female ornaments in the Eurasian kestrel *Falco tinnunculus*, a sexually dichromatic species for 8 years: grey colouration in rump and tail and the width of the black subterminal tail band. We analysed whether these ornaments varied with age, among years, and with indexes of quality, breeding performance and pathogen richness. We found that 1) female melanin-based ornaments increased from yearlings to adults but not later in their life; 2) a significant among-year variation in rump coloration and tail band-width; and 3) a positive correlation of grey rump coloration and clutch size and a negative correlation between grey colouration of rump and tail with pathogen richness. These results suggest that the expression of these melanin ornaments is environmentally constrained. We propose that melanin-dependent ornamentation in Eurasian kestrels suggests an ecological divergence between sexes for resource competition, indicating that grey colouration in rump and tail may act as indicators of individual quality. No clear functionality has been proposed for the third studied ornament, the black subterminal tail band.

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Poster 151**Social context influences acoustic communication in zebra finches.**

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During a communication process, a signal conveys information between an emitter and a receiver, but indirect receivers can also eavesdrop on the interaction. In birds, communication has been demonstrated to often be under the influence of this eavesdropping. Social species show complex communication networks where audience drives individual behaviors. Zebra finches (*Taeniopygia guttata*) are gregarious songbirds that live in large social groups and form life-long pair-bonds. Social structure depends on male-female vocal interactions which takes place on the public place of the colony. Male zebra finches show mate calls preference over other female calls in the presence of an established male–female pair, but not in the presence of unmated conspecifics. In this study, we use playback experiments to investigate whether this audience effect is based on previous knowledge or current evaluation of social relationships between group-mates by tested males. We also test to see if the audience influences male response to female calls of varied familiarity. Finally, we show that social experience of males and females modifies their calls' acoustic structure. Calls thus appear to be potential badges of social status that could be used during audience assessment by a male.

Poster 152**Effects of passive social support on heart rate in greylag geese (*Anser anser*)**

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In group living vertebrates, social support plays a distinctive role in dealing with stressors. The effects of “active” and “passive” social support on behaviour as well as stress hormones are well known however; the role of social support on heart rate (HR) remains completely un-known in animals. We now studied “passive” social support (i.e. the effect of a partner present) in free-ranging, socially embedded greylag geese. Behaviour, HR and excreted corticosterone metabolites (CORT) were recorded in 16 focal individuals (12 paired, 4 singles) during a high density feeding situation. Singletons had a higher mean HR over the entire feeding time as well as a higher HR during behaviours such as vigilance and feeding. CORT values were significantly higher in single than in paired individuals. Generally, CORT correlated significantly with HR. The results of this study suggest that besides glucocorticoid hormones, also HR is modulated by the presence of a social ally. Such a general covariance between HR and CORT indicates that both the hypothalamic-pituitary-adrenocortical as well as the sympathetico-adrenomedullary axis are modulated the same way by social factors. Our results indicate that as in mammals proper social embedding may reduce physiological investment in the social domain also in birds. Thereby, social allies may affect an individual’s fitness.

The project was funded by FWF projects 18601-B17 to I.B.R. Scheiber and 15766-B03 to K. Kotrschal

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Poster 153**Heart rate of greylag geese (*Anser anser*) during human approach**

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Heart rate (HR) is a sensitive parameter influenced by various internal as well as external stimuli. In the present study we asked, whether approach by humans would affect HR in individual greylag geese even at no behavioural change. Therefore, we recorded simultaneously HR and behaviour of seven free-living, socially embedded male geese, during a human approached slowly. Geese are well habituated to human observers and do not show avoidance behaviour even when approached closely. We suggest HR as a suitable parameter to evaluate the degree of disturbance caused by a human observer. We differentiated between familiar, known and unknown humans. HR increased only when approached closer than 50 cm. HR remained lowest when approached by familiar persons and increased most substantially when approached by strangers. Our results show, that even at no behavioural change, geese responded physiologically to human approach and they differentiated between familiar and non-familiar humans. Our results show, that appropriately acquainted humans neither affect the behaviour nor the physiology of focal individuals.

The project was funded by FWF projects 18601-B17 to I.B.R. Scheiber and 15766-B03 to K. Kotrschal.

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Poster 154**Natural variation in behavioural type of a cooperatively breeding cichlid**Witsenburg W. fardo<sup>1</sup>, Schuerch Roger<sup>2</sup>, Otti Oliver<sup>3</sup>, Heg Dik<sup>2</sup><sup>1</sup>Animal Ecology Group, Centre for Ecological and Evolutionary Studies, University of Groningen, Kerklaan 30, 9751 NN Haren, The Netherlands,<sup>2</sup>Department of Behavioural Ecology, Zoological Institute, University of Bern, Wohlenstrasse 50a, CH-3032 Hinterkappelen, Switzerland,<sup>3</sup>Department of Animal and Plant Sciences, University of Sheffield, Western Bank, Sheffield, S10 2TN, United Kingdom,

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Consistent intercorrelated variation of behaviours, known as ‘behavioural syndrome’ has been identified in populations of a broad range of animal species. Important questions now arise on how the different behavioural types influence their distribution and their life-history traits. *Neolamprologus pulcher* is a cooperatively breeding cichlid and faces many important life-history decisions about dispersal and helping effort that have to be traded off against each other. We assessed the behavioural type of size matched subordinates in their natural environment by quantifying their aggression against a competitor, anti-predator behaviour, roaming behaviour and helping effort.

A PCA grouped all behaviours but one in the first component, showing a strong intercorrelation. Surprisingly, roaming was negatively correlated with the other behaviours. Digging, as a measure of help, did not load into this ‘personality component’ and its rank orders were not maintained over time. In larger breeding groups, subordinates were more aggressive and less exploratory. Location in the colony, predator density nor competitor density influenced the distribution of behavioural types.

Our study highlights the importance of field studies in understanding life-history consequences of variation in behavioural type. Though we could find no spatial pattern in the distribution of types, only a long-term field study could exclude any effect of personality on dispersal.

Poster 155**Agonistic behaviour of workers of the red wood ant *Formica polyctena* Först. during aggression tests with workers of *Formica fusca* L. and *Cataglyphis aenescens* Nyl.**

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We compared agonistic behaviour shown by foragers of the red wood ant *Formica polyctena* during dyadic encounters with foragers of two other ant species: *Formica fusca*, a non-territorial, little aggressive species living in small colonies and frequently sharing the same habitat with *F. polyctena*, and *Cataglyphis aenescens*, a species preferring arid zones with sparse vegetation and, therefore, inhabiting different habitats than *F. polyctena*, although workers of these two species may occasionally meet when foraging. The first aggressive physical contact between the workers and the first fight occurred more rapidly in the tests with *C. aenescens*. Biting was more frequent and had longer total duration in the tests with *C. aenescens*. Threats (open-mandible threats and gaster flexing) and attacks (rapid lunges in the direction of another ant not necessarily followed by a fight) were more frequent and had longer total duration in the tests with *F. fusca*. Frequency and total duration of fights did not differ between the tests with *C. aenescens* and *F. fusca*. Relative prevalence of escalated aggression (biting) over threats in the tests with *C. aenescens* seems to be related to higher aggressiveness of workers of that species, expressed, among others, as frequent “mobbing behaviour” directed to workers of *F. polyctena*. We also observed several cases of death of workers of *C. aenescens* apparently unrelated to any serious physical damage and suggesting their high susceptibility to stress.

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*Notes*

Poster 156**Do kea (*Nestor notabilis*) solve mechanical problems according to prior non-rewarded exploration experience?**Wolf Claudia C.<sup>1</sup>, Gajdon Gyula K.<sup>2</sup>, Buerger Corinna<sup>3</sup>, Huber Ludwig<sup>1</sup><sup>1</sup>University of Vienna, Department for Neurobiology and Cognition Research, Althanstrasse 14, A-1090 Vienna, Austria,<sup>2</sup>University of Vienna, Department for Neurobiology and Cognition Research, Althanstrasse 14, A-1090 Vienna, Austria AND Konrad Lorenz Institute for Ethology, Savoyenstrasse 1a, A-1160 Vienna, Austria,<sup>3</sup>Department of Biopsychology, Institute of Cognitive Neuroscience, Faculty of Psychology, Ruhr University Bochum, 44780 Bochum, Germany,

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The question whether information that is gathered in a non-rewarded context is used for later problem solving addresses a key feature of cognition. Latent learning of orientation in a maze was found in rodents but little is known about whether animals are able to learn latently when investigating mechanical affordances of objects. Here we show data of two mechanical problem tasks which were conducted with kea, a highly explorative mountain parrot of New Zealand. In both experiments, subjects were given the possibility to explore the apparatus before they were baited with a reward. In a first cognitively more demanding task, all adult kea failed to solve the task after prior non-baited exploration experience at the apparatus. In a second cognitively less demanding task, adult but not young kea that had prior access to the apparatus did perform significantly better than kea that were given no such opportunity. Results indicate that the ability to solve mechanical problems according to previous non-rewarded experience requires well developed cognitive skills in kea.

Poster 157**Does developmental stress affect female choice in the zebra finch?**

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Stressors during early development have been shown to have detrimental effects on the development of various secondary sexual traits in male birds and to reduce their attractiveness to females. The effects of developmental stress on female preferences, however, remain largely unaddressed. This study tests whether developmental stress affects the ability of females to discriminate between potential mates on the basis of visual signals. Female zebra finches were raised under control conditions or nutritional stress during days 5-30 post-hatching. In adulthood, the influence of nutritional stress on female mate choice preferences was assessed using an Amsterdam apparatus, allowing females to rank novel adult males. Whilst nutritional stress had a significant effect on the growth rate of birds during the period of stress, stressed individuals later compensated for reduced growth. Stressed females showed no agreement in preference ranking of males, either with each other or with controls. Contrary to expectations, control females also showed no significant agreement in preference ranking of males. Possible explanations for this unusual result will be explored. Interestingly, stressed females were found to be significantly less active than controls. This is a novel finding and we hypothesise that rearing environment has long term fundamental effects on adult behaviour. The consequences for mate choice decisions using both visual and acoustic mate choice cues will be discussed.

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*Notes*

Poster 158**First demonstration of the use of geometrical information for navigation in an invertebrate**

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This study investigates, for the first time in an invertebrate species, the ability of using navigational cues provided by the geometry of the environment. We adapted the Cheng's paradigm (1986), formerly used on different species of vertebrates, to the formicine ant *Gigantiops destructor*. To return to their nest from the centre of a rectangular arena, disorientated foraging ants had to reach one of the four corners. When external cues from the experimental room (exposed beams and neon lights) were available, ants succeeded in re-orientating and regained the correct corner. When the rectangular arena was isolated from these external cues, ants headed along the axis including the correct corner and the diagonally opposite one and consequently selected the corner located at 180° rotation from the correct corner through the centre as often as the correct corner itself. While making such systematic rotational errors, ants must have been using spontaneously the geometric relations between walls and corners of the rectangular arena shape (geometrical cues). In further tests, the four corners were individually marked with distinct visual shapes (featural cues). Ants primarily relied on the geometrical information of the environment for reorientation from the centre of the arena before using the featural information to pinpoint the correct corner. Taken together, the spatial cognitive abilities displayed by these insects are discussed and compared to those of vertebrates.

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Poster 159**Collective parental care in Mallards: a crèching strategy?**

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A crèche is defined as a group of animals containing any number of adult females and young, two or more of which being parentally unrelated. Crèching behaviour is widespread among animals, especially in colonial species, and several hypotheses have been proposed to account for this behaviour. Coloniality was usually associated with several life history traits, one of them being crèche formation. This behaviour was considered as adaptive because it may improve juveniles's survival and thus parental fitness. In this study, we investigated whether the formation of crèches could be induced by environmental factors such as limited space areas. Observations were conducted on mallards, a non-colonial duck species in which crèches have rarely been reported. We recorded post-hatching parental care of two groups of seven hens in 100 m<sup>2</sup> aviaries. We observed crèching behaviour in both groups including brood gathering and females tolerating all ducklings. Nevertheless, the parental care index of the hens was not different from the species norms and no difference between females was found either. Moreover, no sharing of parental care was observed. We can conclude that, in our conditions of restricted areas, we observed real crèching behaviour in a usually 'lone tender' species when in natural conditions. It appears that environmental factors could be responsible for the development of crèches and that promiscuity, in particular, could induce crèching behaviour.

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*Notes*

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